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AND OF THE

INSTITUTIONS IN UNION.

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No. 313. FRIDAY, NOVEMBER 19, 1858. Vol. VII.

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FIRST ORDINARY MEETING.

WEDNESDAY, Nov. 17, 1858.

The First Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 17th inst., Mr. C. Wentworth Dilke, the Chairman of the Council, in the chair.

The following Institutions have been taken into Union since the last announcement:—

Rochdale, Young Men's Christian Association.
Glasgow, Institution.

The CHAIRMAN delivered the following

ADDRESS.

In appearing before you a second year, it is my duty to explain the circumstances under which I have been elected Chairman of Council, inasmuch as the Bye-Laws state that the office of Chairman is not to be held by any member two years in succession. It will be in the recollection of all, that at the commencement of the Society's year in July 1857, the new Council, at their first meeting, elected a Chairman, and that in the following October, the chair having become vacant, I had the honour to be elected to fill it for the remainder of the year. This year, on proceeding, after the Annual Meeting, to nominate the Chairman, the Council resolved, by distinct vote, that the holding office for part of a year did not disqualify from re-election, and they were pleased again to honour me with their confidence. I hope that at the end of the year I shall have merited the compliment.

In the address read last year three subjects were prominently noticed as requiring the attention of the Council—Artistic Copyright, Parcels Post, and Resources of India.—Considerable progress has been made with reference to the amendment of the law of Artistic Copyright. The Committee, composed as it was of men eminent as painters, sculptors, engravers, and patrons of art, lawyers, and others well acquainted with the subject, having for their Chairman Sir Charles Eastlake, the President of the Royal Academy, at the end of the last Session made their report to the Council, embodying the principles on which any amendment of the law should be based, and they accompanied that report with a draft of a Bill for carrying their views into effect. This report, however, was not made until it was too late to bring the matter fully before the Legislature. Nevertheless, Lord Lyndhurst, who kindly undertook the charge of the Society's petition to the House of Lords, on presenting it as well as petitions from other bodies and individuals, moved for and obtained a Committee of Inquiry on the subject. Owing, however, to the session of Parliament then drawing near its close, this Committee did not enter on the inquiry, but it is hoped that, on the opening of Parliament next year, the Committee will be re-appointed, and that the Session will not close without some well-considered amendment of the law. The Council have already appointed a small Committee, on which Sir Charles Eastlake has consented to serve, for the purpose of taking such measures as may be thought right for best promoting in the Legislature those views which the large and influential Committee of the Society, last year, set forth in their Report.

In regard to the Parcels Post, the Committee on that subject prepared a most able report, which the Council published in the *Journal*, and sent round to the Chambers of Commerce and Institutes in Union. It is now necessary that further steps should be taken to have the principle well considered by the public, and the Council have under consideration the advisability of appointing an evening for its discussion.

The question of "Indian resources" was not proceeded with because it was thought that in the present state of our Indian Empire it would be almost impossible to enter fully into the discussion of the subject without risking political allusions—most undesirable at all times at meetings like those of this Society. This subject will, however, at an early period, be again brought under consideration.

Another subject, however, of great importance, occupied much of the attention of the Council, viz., the propriety of holding a second Great Exhibition in 1861.

The views laid before the Council were carefully considered at several meetings, most of them very fully attended, and it was resolved that it would promote Industry, Art, and Commerce, to hold Decennial Exhibitions. The French nation, who are entitled to the credit of having originated such exhibitions, though limited to native industry, have held twelve since 1798, that is, on an average, one every five years. The number of exhibitors demonstrate that such exhibitions met the wants of the commercial world of France, for they increased steadily on each occasion. In 1798 there were 110; in 1819, 1662; in 1849, 4494; and in 1855, 9790 French exhibitors alone.* The great increase in the numbers of exhibitors in 1855 may no doubt be mainly attributable to the extension, for the first time in France, of the principle of the admission of the products of all nations, as had been so successfully carried out by us in 1851.

Englishmen, too, feel the benefits that result from exhibitions. Look at the progress which horticulture has made since the commencement of the Exhibitions of the Horticultural Society of London. Look at the Royal Agricultural Society of England, which has held twenty consecutive annual shows from 1839 to 1858, and on the last occasion—at Chester—there were more exhibitors of cattle and implements, more visitors attended, and the receipts were larger than they had ever been before, and there was a larger contribution from the town itself.†

It may be of interest to know, as confirming these views, that the Council of the Royal Agricultural Society, on the motion of Mr. Brandreth Gibbs,—the Hon. Superintendent of the arrangements for the exhibitions, and therefore most intimately acquainted with the feelings of exhibitors,—have decided on holding in 1861, if a site can be found, a Great Metropolitan Exhibition of Cattle and Implements, a proof that the London Exhibition of Implements in 1851 was satisfactory to exhibitors and useful to the agricultural world. It is also an undoubted fact that the shows of Agricultural Implements by the Royal Agricultural Society have led to such improvements in their design and manufacture as to have created a large and important export trade, prominently figuring in our export returns.

It has been said that 1861 is too soon for another International Exhibition. Many, on the contrary, and by far the greater number, so far as opportunity has hitherto been afforded for ascertaining public feeling, are of opinion that, if any benefit is to be derived from comparison, the intervals between one exhibition and another should be less rather than more than ten years: one-third of a generation will have passed away from among us since 1851; one-half, if we look only at the working interests of the world. With the knowledge, then, that the French think five years a sufficient time to intervene; that the Agricultural Society of England meet year after year with increasing success, the Council came to the conclusion that Decennial Exhibitions of Art and Industry would be beneficial. Great changes have taken place in the position of many classes of manufacture since 1851. Manufacturing firms scarcely known at that date have increased and improved their productions in a remarkable manner, and not a few attribute much of their success to the healthy action of the Great Exhibition of 1851, and the publicity given to comparatively unknown—but in many instances highly meritorious—manufacturing establishments. New phases of mechanical invention and of the application of scientific and artistic knowledge to industrial purposes have been developed. The Catalogue and Jury Reports of the Exhibition of 1851 have proved, as was anticipated, most valuable European directories, constantly referred to by buyers from all parts of the world. The catalogue of another Exhibition would present all the features of a timely revisal of a work which has proved of more than ordinary use to mercantile men. The Council, however, whilst considering the subject generally, arrived at the conclusion that two new features ought to be introduced, viz., music and painting; and that every article exhibited should mark progress, and be exhibited in classes,

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* FRENCH EXHIBITIONS OF INDUSTRY.

1789...	110	1827...	1795
1801...	229	1837...	2447
1802...	540	1839...	3281
1806...	1422	1844...	3960
1819...	1662	1849...	4494
1823...	1642	1855..	9790

† Date.	Place.	Town Contribution.	Amount paid for Admission.			No. of Implement Exhibitors.	No. of Stock Exhibitors.	No. of Head of Cattle Exhibited.
		£	£	s.	d.			
1839	Oxford...	...	...			...	...	350
1840	Cambridge...	...	...			...	...	451
1841	Liverpool ...	...	...			...	...	463
1842	Bristol...	...	...			84	...	497
1843	Derby ...	...	...			113	...	608
1844	Southampton ...	1000	2432	3	2	99	...	716
1845	Shrewsbury ...	1000	1682	19	5	93	...	527
1846	Newcastle ...	1000	2168	15	11	110	...	775
1847	Northampton ...	1200	2473	11	0	142	...	580
1848	York ...	1000	2514	12	0	146	...	866
1849	Norwich ...	1000	2360	15	10	145	...	799
1850	Exeter...	1260	2493	19	4	118	...	769
1851	Windsor ...	600	3397	4	9	...‡	...	1226
1852	Lewes ...	1500	1184	10	4	105	247	828
1853	Gloucester ...	1500	2734	0	11	128	355	931
1854	Lincoln ...	1500	3378	6	5	130	331	939
1855	Carlisle ...	1400	3260	13	10	121	280	1076
1856	Chelmsford ...	1200	2988	8	5	151	318	906
1857	Salisbury ...	1500	3447	15	9	156	356	1462
1858	Chester ...	1800	6187	5	5	197	402	1444

‡ Implements in 1851 were exhibited in London at the Crystal Palace.

The average number of visitors at the several country meetings, up to the Chelmsford meeting, was found to be about 35,000, but at Salisbury the actual number was 36,023, while at Chester it amounted to no less than 63,866.

and not in nations, as in 1851. Those, for example, who wish to study silks, should have all silks brought at once before their view, and not be obliged to run from one end of the exhibition to the other, from Spitalfields to Genoa, and back to Lyons; those, again, whose trade is in ribbons, should be able at once to study the combinations of Coventry and the colours of Switzerland.

The questions which will naturally arise, and which it will probably fall to the province of the Council to solve, will be the management to which the Exhibition should be confided, and the means of raising the necessary funds. The first step will, of course, be to ascertain how far the Commissioners of the Exhibition of 1851 are willing or able to carry on such an undertaking, or if not, how far they will assist and support the proposed Exhibition.

The Council will, therefore, at an early period, proceed to communicate their views to the Commissioners, and institute an inquiry how far those views are entertained and supported by the public and by the manufacturing and commercial world at large. Much of the business of this session, must, therefore, have especial reference to the proposed exhibition of 1861. The Council propose to call together some of the committees of the various classes into which the exhibition will probably be divided, and to ask their opinions as to the special wants in each class.

During the past year, the Council has also directed its attention to the collection of information likely to be beneficial to trade and commerce, and of use to intending emigrants to our Colonies. Several valuable papers relating to the vegetable productions and mineral wealth of particular Colonies, have been read at our weekly evening meetings, and the success and interest of these papers induced the Council to consider the propriety of nominating a Colonial Committee for the collection of information relating to the climate, vegetable, animal, and mineral products, of our several colonies, and for the reception and exhibition of specimens and samples of produce, whenever and from wherever they can be obtained. The want of some such centre, where the scattered information relative to the trade and commerce of Great Britain and her colonies might be collected and thus made available, has long been felt by the Council. Unlike Manchester, Liverpool, and other large towns in the kingdom, London has no Chamber of Commerce. The Council therefore hope and believe that great and permanent good must result from the establishment of this Committee to the benefit equally of the colony and the mother country, and the Council have already ascertained that the Colonial Minister, Sir Edward Bulwer Lytton, is willing to co-operate with the Society in this object, and forward communications from the Society to the several Governments and Chambers of Commerce in the Colonies.

The Examinations in connexion with the Institutes in Union with the Society have been held this year with complete success. It will be remembered that, in order to make it possible to extend the Examinations throughout the Union, and to prevent the system from becoming too greatly centralised, the last Council introduced certain changes, the two most important of which provided that the Society's Final Examinations should be conducted by papers worked under proper supervision in the several localities, instead of bringing the candidates to two or three centres; and that every candidate admitted to these Examinations must have previously undergone an examination before a Local Board appointed by the authorities of his Institute. The effect of these changes has been most satisfactory; fifty-nine Local Boards were formed; the Society's Examinations were held at thirty-two different places, and the awards were given by the Society's Examiners in London without confusion or difficulty. The Council will carry out the Examinations of 1859 in the same manner. A programme, specifying all the arrangements, has been already issued; the number of Local Boards prepared to act is already increased; and it may be hoped that even a larger number of candidates than in previous years will avail themselves of the Examinations in 1859. The Council has the advantage of the services of the same distinguished Board of Examiners as on the last occasion.

The names of the following gentlemen have been reported to the Council as contributors to the Examination Prize Fund :—

Mr. Haden	Two Guineas.
„ Haldimand	Ten Guineas.
„ Highton	Two Guineas.
„ Holmes	One Guinea.
„ Henry Johnson ...	Twenty-five Pounds.
„ C. Ratcliffe	Ten Guineas.
Rev. F. Temple, D.D...	Six Guineas.
„ A. Wilson	Two Guineas.
Mr. Wentworth Dilke..	Ten Guineas.

The members have already been informed that, at the request of the Council, Lord Derby kindly consented to place in their hands the privilege of selecting from the successful candidates at the last Examinations of the Society, four to be nominated to compete for situations in the gift of the Treasury. Two nominations have already been made. There were four vacancies to be filled up, and twelve competitors, and it must be a matter of congratulation to the members of the Society to know, that both the nominees selected by the Council, Mr. Thomas Ross Howard, of the Crosby-hall Evening Classes, and Mr. George Edward Skinner, of the

Lymington Literary Institution, were successful in obtaining appointments—Mr. Howard standing first and Mr. Skinner third.

The Council is engaged in an endeavour to bring the advantages of union with the Society within the reach of a greater number of Institutes.

The Committee on Surgical Instruments, which it was proposed to form last year, has met, elected its officers, and divided itself into sections, representing the various branches of the subject. More than sixty medical men of eminence have consented to act, and Mr. James Luke has been elected to the office of President, with Drs. Watson and Budd, Mr. Henry Charles Johnson and Mr. Richard Partridge as Vice-Presidents, and Mr. Seymour Haden and Mr. Mitchell Henry as reporters. At a general meeting of the Committee, to be held before the close of the year, it will be proposed to adopt measures having for their primary object a complete classification of all the mechanical contrivances applied to medicine and surgery, so as to insure, in any future exhibition, a more complete illustration of that branch of industry than was attempted in 1851, and, secondly, to further the interests of the public and the medical profession by inducing manufacturers to submit their improvements to the examination and award of the Society.

The members are aware that during last Session the Council appointed a Committee to undertake an inquiry into the nature and causes of the decay of Gutta Percha, and as to its sources of supply. This inquiry will naturally extend over a considerable period, and the Committee have been, and still are, actively engaged in carrying on a series of experiments and collecting information. The importance of this inquiry can hardly be over-rated, when it is remembered how largely Gutta Percha is employed for our telegraphs, whether by land or by sea, for tubing, for agricultural, for surgical, and for an almost infinite variety of purposes.

On the 20th of January next, the anniversary of the death of Dr. Swiney, the award of the Prize given under his will will be made. This award takes place on every fifth anniversary of Dr. Swiney's death; and, as there are many new members of the Society who are probably unaware of the nature of this bequest, I may mention that Dr. Swiney, by his will, bequeathed to this Society a sum of Consols on trust, that on every fifth anniversary of his death, they should present "to the author of the best published Treatise on Jurisprudence, a Silver Goblet, of the value of £100, containing gold coin to the same amount." As judges to award the prizes, he asassociated the College of Physicians with the Society of Arts. The first award was made in 1849, the second in 1854, and the third will be made in January, 1859. In the first instance Mr. Maclise, R.A., was commissioned to furnish the Society with a suitable design for the goblet, and from that design the goblet for the next award will be made.

The important improvements which are taking place in the construction of our tools and implements, as well as in the machines employed by our manufacturers throughout the country, are daily increasing in number, while the modifications which have been made in the patent laws, and the advantages which have resulted to the public by the immediate publication of the specifications of the patents themselves, have tended much to the advantage of the inventor and the public at large. The Council would call attention, therefore, to the fact that they have, during the vacation, been engaged in perfecting the arrangement for affording members facilities for reference to the Library of Patent Specifications, and they are now glad to be able to state that they have had a room fitted up for the reception of works issued by the Commissioners of Patents, and the entire series of specifications, from James the First down to the present date, have been bound, and are now ready for reference at all times, but the Council cannot allow any of the volumes to be removed from the premises, as the series must be retained as part of the library of reference.

The Council would also call the attention of members to the Exhibitions of Patented Inventions which it has held yearly since 1848, and which have served as records of the mechanical requirements of the times. The exhibition of the past year had a greater number of exhibitors than the previous year, and the next will open on Easter Monday, March 25th. This series they purpose to continue.

The Council, previous to separating for the vacation, took the necessary steps for preparing a new premium list, and as soon as the committee appointed to consider the question has made its report, the list of subjects will be made public, and they wish it to be understood that medals may be claimed for communications, whether in reference to patented or unpatented processes or machines. In addition to the ordinary list, the Society is this year enabled to offer several special premiums, in conformity with the bequests of Dr. Swiney, Dr. John Stock, and Dr. Fothergill.

Mr. Benjamin Oliveira has placed at the disposal of the Council the sum of £25 to be awarded by them as a gold medal or otherwise, for such subject as they may select. In doing so, they trust that the prize offered may prove as successful in eliciting the desired information as was a former prize offered by Mr. Oliveira, which was awarded to Mr. C. Wye Williams for his Essay on the Prevention of the Smoke Nuisance, an award which was subsequently confirmed by the Committee of the Newcastle Association, who adjudged the sum of £500 to that gentleman for his labours.

The adjudicators appointed by the Society to report on the merits of the twenty-two Essays sent in in competition for the prize of two hundred guineas offered by Mr. Henry Johnson, have made their award, and the prize has been paid, with Mr. Johnson's consent, to Mr. Edward Capps, of Cheshunt-terrace, Bermondsey.

The general list for which medals are offered comprises a large number of subjects. It has been stated by some members that a shorter list and smaller number would be calculated to elicit a larger response from the public. In reply the Council would point attention to the fact that the object of the Society is not to direct attention to the wants of any one branch of industry in particular, but to endeavour to obtain information in reference to wants wherever they believe them to exist, and to stimulate inquiry in such directions as will tend to the progress of trade generally. Such being the view which the Council takes of its functions, the list necessarily extends over a wide field of inquiry, and although apparently a numerous list, the Council feel that they would not be discharging their duty impartially if they kept back any large number of the subjects which are included in it. On the contrary, it would be a far easier task to extend than to diminish the list.

During the spring it is intended to hold two conversazioni, one of which, in accordance with the wishes expressed by a large number of members, will again, if permission be granted by the Committee of Council on Education, take place in the Museum of the Department of Science and Art at South Kensington.

It now becomes my duty as chairman to present the medals which have been awarded by the Council.

The medals were then presented as follows :—

To Mr. J. Algernon Clarke, for his Essay* "On the Application of Steam-power to the Cultivation of the Soil."

To Mr. A. G. Findlay, for his Paper "On the Progress of the English Lighthouse System."

To Mr. Wentworth Lascelles Scott, for "A Self-registering Maximum Thermometer for great depths at Sea."

To Mr. Wm. Stones, for his Paper "On New Zealand and its Resources."

To Mr. F. R. De la Tréhonnais, for his Paper "On the past and present of French Agriculture."

To Mr. John Underwood, for his Paper "On the History and Chemistry of Writing, Printing, and Copying Inks, and a new plan of taking manifold copies of written and printed documents, &c."

To Dr. J. Forbes Watson, for his Paper "On the Composition and Relative Value of the Food Grains of India."

To Mr. William Williams, for his "Machine for Cutting and Dressing Stones for Building Purposes."

To Mr. J. W. Wilson, for his "Combination of the tubular gouge and disc-paring tool for wood-shaping machinery."

To Professor John Wilson, F.R.S.E., for his Paper "On Canada: its Productions and Resources."

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* This Essay was sent in competition for the Medal offered in the Society's Premium List.

The Secretary announced that on Wednesday evening next, the 24th inst., a paper by Mr. F. Joubert, "On a Method of rendering Engraved Copper-Plates capable of Producing a greatly-increased Number of Impressions," would be read. On this evening George T. Doo, Esq., R.A., will preside.

VEGETABLE PARCHMENT.

The following report in reference to this substance has been addressed to Messrs. Thomas De La Rue and Co., by A. W. HOFMANN, LL.D., F.R.S., Professor of Chemistry to the Government School of Mines :—

In accordance with your request, I have carefully examined the new material, called vegetable parchment, or parchment paper, which you have submitted to me for experiment, and I now beg to communicate to you the results at which I have arrived.

I may here state that the article in question is by no means new to me; I became acquainted with this remarkable production very soon after Mr. W. E. Gaine had made known his results, and I have now specimens before me which came into my possession as early as 1854. My attention was again called to the subject in 1857, when my friend, Mr. Barlow, delivered an interesting discourse upon vegetable parchment, at one of the Friday evening meetings of the Royal Institution.* Hitherto, however, I had not myself experimented upon the subject.

The substance submitted to me for examination exhibits in most of its properties so close an analogy with animal membrane, that the name adopted for the new material seems fully justified. In its appearance, vegetable parchment greatly resembles animal parchment; the same peculiar tint, the same degree of translucency, the same transition from the fibrous to the hornlike condition. Vegetable, like animal parchment, possesses a high degree of cohesion, bearing frequently repeated bending and rebending, without showing any tendency to break in the folds; like the latter, it is highly hygroscopic, acquiring by the absorption of moisture increased flexibility and toughness. Immersed in water, vegetable parchment exhibits all the characters of animal membrane, becoming soft and slippery by the action of water, without, however, losing in any way its strength. Water does not percolate through vegetable parchment, although it slowly traverses this substance like animal membrane by endosmotic action.

In converting unsized paper into vegetable parchment or parchment paper by the process recommended by Mr. Gaine, viz., immersion for a few seconds into oil of vitriol diluted with half its volume of water, I was struck by the observation how narrow are the limits of dilution between which the experiment is attended with success. By using an acid containing a trifle more of water than the proportion indicated, the resulting parchment is exceedingly imperfect; whilst too concentrated an acid either dissolves or chars the paper. Time, also, and temperature are very important elements in the successful execution of the process. If the acid bath be only slightly warmer than the common temperature, 60° F. (15.5° C.)—such as may happen when the mixture of acid and water has not been allowed sufficiently to cool—the effect is very considerably modified. Nor do the relations usually observed between time, temperature, and concentration appear to obtain with reference to this process; for an acid of inferior strength, when heated above the common temperature, or allowed to act for a longer time, entirely fails to produce the desired result. Altogether the transformation of ordinary paper into vegetable parchment is an operation of considerable delicacy, requiring a great deal of practice; in fact, it was not until repeated failures had pointed out to me the several conditions involved in this reaction, that I succeeded in producing papers in any way similar to those which you have submitted to me for experiment.

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* On some Modifications of Woody Fibre, and the Applications, by the Rev. J. Barlow, M.A., F.R.S., &c.—*Proceedings of the Royal Institution of Great Britain.*

Mr. Barlow, in the discourse on woody fibre to which I have alluded, records some experiments establishing that unsized paper, by its conversion into vegetable parchment, receives no appreciable increase of weight. These experiments rendered it very probable that the action of sulphuric acid in this case is essentially molecular, and that the chemical composition of the substance of the paper by its conversion into parchment is not altered. It remained to establish this point experimentally. For this purpose several of the specimens of commercial vegetable parchment, without any further purification, were submitted to analysis. The result showed that—with the exception of about 0.9 per cent of mineral matter, a quantity not much exceeding the amount which is present in the better varieties of ordinary paper—the substance of vegetable parchment *is identical in composition with cellulose or woody fibre.* The analytical experiments demonstrate—as might have been expected—that the extraordinary change which the properties of paper undergo during its transformation, depends solely and exclusively upon a molecular re-arrangement of the constituents, and not upon any alteration in the composition of the paper. In this respect, the action which sulphuric acid exerts upon woody fibre, may be compared to the transformation of woody fibre under the protracted influence of the same agent into *Dextrin,* a substance altogether different from fibre, but still identical with it in composition. Vegetable parchment may, in fact, be looked upon as the connecting link between cellulose on the one hand, and dextrin on the other.

Thus it is obvious that the transformation, under the influence of sulphuric acid, of paper into vegetable parchment, is altogether different from the changes which vegetable fibre suffers by the action of nitric acid; the cellulose receiving, during its transition into pyroxylin and gun-cotton, the elements of hyponitric acid in exchange for hydrogen, whereby its weight is raised, in some cases by forty, in others by as much as sixty per cent. As the nitro-compounds thus produced differ so essentially in composition from the original cellulose, we are not surprised to find them also endowed with properties altogether different; such as increased combustibility, change of electrical condition, altered deportment with solvents, &c., whilst vegetable parchment, being the result of a molecular transposition only, in which the paper has lost nothing and gained nothing, retains all the leading characters of vegetable fibre, exhibiting only certain modifications which confer additional value upon the original substance.

The nature of the reaction which gives rise to the formation of vegetable parchment having been satisfactorily established, it became a matter of importance to ascertain whether the processes used for the mechanical removal of sulphuric acid from the paper had been sufficient to produce the desired effect. It is obvious that the valuable properties acquired by paper, by its conversion into vegetable parchment, can be permanently secured only by the entire absence or perfect neutralisation of the agent which produced them. The presence of even traces of free sulphuric acid in the paper would rapidly loosen its texture, the paper would gradually fall to pieces, and one of the most important applications which suggest themselves, viz., the use of vegetable parchment in the place of animal parchment for legal documents, would thus at once be lost.

Examination of the vegetable parchment for free sulphuric acid was, therefore, one of the principal points to which I had to direct my attention. From the description of the process adopted in preparing the new material, viz., long-continued mechanical washing with cold water, immersion in a dilute solution of caustic ammonia, and, lastly, renewed washing with water, the absence in it of free sulphuric acid may be at once inferred on scientific grounds. For, supposing that the first process of washing had left any free sulphuric acid in the paper, this acid, after immersion of the paper in caustic ammonia, for which it has so strong an attraction, could have remained only in the form of sulphate of ammonia, a salt of perfectly neutral composition, in which the acid character of sulphuric acid is entirely lost. Now, sulphate of ammonia is a most stable compound, which begins to decompose only at about 536° F. (280° C.), a temperature at which paper is completely destroyed, and even then, no free sulphuric acid is to be found amongst the products of decomposition. But the paper is washed again after treatment with ammonia, and obviously only traces of sulphate of ammonia can remain in it.

The absence of free sulphuric acid in the parchment paper was, moreover, established by direct experiment. The most delicate test-papers left for hours in contact with moistened vegetable parchment, did not exhibit the slightest change of colour. Several square feet of parchment paper were cut up into small pieces, and boiled for half a day with water; the liquid was filtered off, and the solution concentrated to a few drops. The liquid thus obtained was found to contain sulphate of lime and sulphate of ammonia, and slightly reddened blue litmus paper, in consequence of the presence of the sulphate of ammonia, which though neutral of composition, like so many other neutral salts, affects vegetable colours. In fact, on dissolving pure sulphate of ammonia, which had been crystallized, from a solution purposely rendered alkaline by the addition of ammonia, a solution was obtained, exhibiting even a greater effect upon blue litmus-paper. The absence of free sulphuric acid in this liquid was, moreover, directly proved, for paper moistened with this concentrated liquid, and dried at 212° F. (100° C.) exhibited no kind of disintegration, the liquid producing, in fact, not more effect upon paper than common water. This experiment appears to me conclusive; for, supposing even an extremely minute quantity of free sulphuric acid in the vegetable parchment, it is obvious that, by withdrawing this acid from a considerable quantity of paper, and concentrating its action upon a single strip at as high a temperature as that of boiling water, a very perceptible effect of disintegration would have resulted.

From the above considerations and experiments, I conclude that vegetable parchment, as prepared by the process which you describe in your letter, and as represented by the samples accompanying it, does not contain a trace of free sulphuric acid. I conclude, moreover, that the sulphates, of which minute quantities are present in this as in almost every variety of paper, cannot possibly develop free sulphuric acid by any influences to which the vegetable parchment is likely to become exposed. There is no reason, therefore, to believe that vegetable parchment, prepared as it is by one of the most powerful agents of decomposition, carries within itself the germ of its own destruction.

In addition to the experimental evidence already adduced, it may be stated that if such were the case, a change would become perceptible after a comparatively limited period; but specimens of Vegetable Parchment which have been in my possession for upwards of four years, cannot by any possibility be distinguished from the samples which you have forwarded, and which I presume have been only recently made.

The absence of free sulphuric acid in Vegetable Parchment having been satisfactorily established, it remained only to perform a few experiments on the strength of this material as compared with that of the animal parchment, with which it is likely to enter into competition. For this purpose, bands of vegetable andof animal parchment both $\frac{7}{8}$ of an inch in width, and as far as possible of equal thickness, were slung round a horizontal cylinder, and appropriately fixed by means of an iron screw-clamp pressing both ends upon the upper part of the cylinder. The band assumed in this manner the shape of a ring, into the bend of which a small cylinder of wood was placed projecting on each side about an inch over the band and carrying by means of strings fastened to each end a pan, which was loaded with weights until the band gave way. A set of experiments* made in this manner led to the result, that paper by exposure to the action of sulphuric acid in the manner described, acquires about five times the strength which it previously possessed, and that for equal weights, vegetable parchment posseses about three-fourths the strength of animal parchment. It was found, moreover, that bands of vegetable parchment taken from different sheets of the same kind of paper, exhibited a remarkable uniformity of strength, whilst in animal parchment, which, owing to its mode of manufacture, must always present considerable inequality of thickness, extraordinary variations were observed, even if the bands were taken from the same skin. These results differ somewhat from those observed by Mr. Barlow, who found the strength of vegetable parchment higher than it would appear to be from my experiments. This discrepancy may probably arise from the fact that Mr. Barlow experimented with specially prepared paper, whilst I operated purposely on samples representing the commercial article, such as it is manufactured on a large scale.

Vegetable parchment, then, as far as strength goes, is not quite equal to animal parchment. On the other hand, the new article greatly surpasses real parchment in its resistance to the action of chemical agents, and especially of water. As has been already stated, vegetable, like other parchment, absorbs water and becomes perfectly soft and pliable; but it may remain in contact, and even may be boiled with water for days, without being affected in the slightest degree, retaining its strength, and regaining its original appearance on drying; on the other hand, it is well known how rapidly animal parchment is altered by boiling water, by the protracted action of which it is converted into gelatine. Even at the common temperature, animal parchment, in the presence of moisture, is very prone to putrefactive decomposition, whilst parchment paper, in which nitrogen, this powerful disturber of chemical balance, is absent, may be exposed to moisture, without the slightest change either in appearance or properties. It would in fact be difficult to find a paper-like material endowed with greater power of resistance to the disintegrating influences of water than vegetable parchment.

Taking into consideration the chemical composition of the new material, its cohesive power, and its deportment with chemical solvents, especially water, both at the common temperature and at the temperature of its boiling point, it is obvious that this substance unites in itself, in a most remarkable manner, the conditions of permanence and durability, and I have no hesitation in stating my belief that vegetable parchment properly prepared, is capable of resisting the tooth of time for many centuries, and that under various circumstances it will last even longer than animal parchment.

The valuable properties of vegetable parchment suggest a great variety of applications for the new material.

There is no doubt that parchment paper may be adopted, with perfect security, for all legal documents, policies of insurance, foreign bills of exchange, bills of lading, scrip certificates, and other similar documents, as a substitute for the skins which are now generally used. On the other hand, its comparatively low price would appear to suggest its application in a variety of cases, in which, at present, paper is employed: for instance, for private ledgers of banking-houses, or other large establishments, as well as for registries of wills, marriages, baptisms, and deaths. Even for the manufacture of bank notes it may be found useful; indeed, for all documents, the preservation of which is of importance. Many of the documents in question, in order to protect them from injury in case of fire, are generally kept in safes, the majority of which are now encased in solid water,—the water of crystallisation in alum, and other similar hydrated compounds. The interior of these safes, in case of exposure to heat, must, obviously, become filled with steam of a high temperature, and it cannot be doubted that documents written on vegetable parchment, owing to the extraordinary power with which this material resists the action of boiling water and of steam, will stand a much better chance of preservation under such circumstances than those written on common paper or animal parchment.

As another advantage of vegetable parchment as compared with animal parchment, the experience may be quoted that vegetable textures are much less attractive to insects than animal structures. Moreover, to increase the security of vegetable parchment in this respect, the paper, before conversion, may be incorporated with chemical agents, which, like salts of mercury, for instance, have been employed with such advantage in the manufacture of paper for public records.

In considering the applicability of vegetable parchment for legal documents, another property of this remarkable material, although perhaps of minor importance, deserves nevertheless to be noticed. This is the great difficulty with which words are erased from its surface, and others are substituted in their places. Deeds written on parchment paper acquire thereby a certain degree of security against falsification.

Its strength and resistance to water appear to recommend parchment paper in an eminent degree for engineers' and architects' plans, and especially for their working plans, which are often unavoidably subjected to rough usage and moisture. The thinner sheets of parchment paper, on account of their transparency, present the additional advantage of being useful as a most durable tracing paper.

In consequence of its strength and resistance to water, vegetable parchment would probably find many applications for military purposes; thus it promises to furnish an excellent material for water-proof cartridges.

Another field of considerable extent for the application of vegetable parchment appears to be in book-binding, and especially in ornamental book-binding. The books bound in parchment paper which accompanied your letter, are remarkable for the beauty and solidity of their binding. Experienced book-binders, to whom I submitted these books, believed them to be bound in real parchment. Even in the manufacture of books and maps which, like those used for educational purposes, like military plans and nautical charts, have to stand considerable wear and tear, parchment paper may find a very useful application. The printing on ordinary paper is not changed by the treatment with sulphuric acid, but owing to the shrinking of the paper during the process, it will probably be found more convenient for such pur-

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* The following are the details of these experiments:

WATER LEAF PAPER.

broke, when loaded with

I.	II.	III.	Mean.
17lbs.	15lbs.	15lbs.	15.6lbs.

VEGETABLE PARCHMENT.

broke, when loaded with

I.	II.	III.	Mean.
78lbs.	75lbs.	70lbs.	74lbs.

ANIMAL PARCHMENT.

broke, when loaded with

I.	II.	III	Mean.
92lbs.	78lbs.	56lbs.	75lbs.

The strips of vegetable and animal parchment were selected as nearly as possible of equal thickness, but the strips of artificial product were somewhat heavier than those of real parchment. On an average the former weighed 18 grains, and the latter only 12.75 grains. Calculated for equal weights, the strength of animal parchment as compared with that of artificial parchment, is obviously $\frac{18}{12.75} + 75 = 105$. In round numbers, it may be said that vegetable parchment has three-fourths the strength of animal parchment.

poses to print on the paper after it has undergone the transformation. Vegetable parchment is remarkable for the facility with which printer's ink, as well as writing ink, may be applied to it, and for its attraction for dyes generally, many of which it appears to take even more readily than calico. The specimens of dyed parchment paper, which accompanied your letter, leave nothing that could be desired in this respect.

Among the numerous more or less important applications in which parchment paper is sure to be found useful as soon as it becomes accessible to the general public, its adaptation for household, and especially for culinary purposes must not be left unmentioned.

In closing the orifices of vessels for preserves, &c., few housewives will hesitate to substitute an elegant material like vegetable parchment paper for the animal membrane, so frequently offensive, which is now generally in use.

Formed into bags of which the seams are cemented with the white of egg, parchment paper will be found very useful for the purposes of boiling and stewing, according to the principles of a refined and scientific *cuisine.*

Nor can the chemist fail to derive some benefit from so interesting an achievement of his own science as the transformation of paper into parchment.

In the laboratory, vegetable parchment will become a material of general use for connecting retorts and condensers, or other similar apparatus, and on account of its indestructibility by many of the fluids usually employed in electric batteries, it will probably find a further and even more important application in the construction of diaphragms for galvanic apparatus.

Royal College of Chemistry.

RATING OF INSTITUTIONS.

The following decision, in reference to this subject, was given in the Court of Queen's Bench on the 13th instant:—

The case stated for the opinion of the Court was, whether the shareholders in the "Bradford Library and Literary Society" were liable to be rated to the poor-rate. The shareholders claimed exemption from the rate upon the ground that the society came within the 6th and 7th Victoria, cap. 36, which, by the 1st section, enacted that no person should be liable to be rated to any county or parochial rates in respect of any land or buildings belonging to "any society instituted for purposes of science, literature, or the fine arts exclusively," provided such society should be wholly or in part "supported by annual voluntary contributions," and should not, and by its laws could not make any dividend or bonus in money among its members, and should also be certified as required by the Act. The society in question had, by a deed dated the 4th of August, 1853, purchased the property in respect of which they were rated, and by a supplemental deed of the 16th of April, 1856, the laws of the society were agreed to and confirmed by the shareholders. The society was duly certified as required by the Act, the premises in the occupation of the society were exclusively used for its objects—being supported by the purchase-money of shares, annual subscriptions of members, rents received from a certain portion of the premises let to tenants who paid rates,—by fines, sale of spoiled books, sale of catalogues, money raised on mortgage of building, and quarterly subscriptions of temporary residents who were subscribers to the library. By the laws no dividend was allowed to be made among the members. The library consisted of the works of standard authors, magazines, novels, and such other books as the committee might admit, and these, together with the other effects of the Institution, were the property of the shareholders, who were limited to 600. The books circulated only among the shareholders and temporary residents in the town, and the library was open each day for the sole use of the subscribers, and temporary residents who obtained free introduction from the proprietors.

Lord Campbell (Chief Justice), on delivering judgment, said he was of opinion the society was entitled to the exemption claimed. He thought the object of the Act was very laudable, but that the means by which it sought to effect it were very questionable, for it seemed to be unjust to call upon the rate-payers of a particular district to pay for the exemption of an Institution to which they had no access, and from which they derived no benefit. But the Legislature had enacted that no person should be assessed to any county or parochial rates in respect of land or buildings belonging to "any society instituted for purposes of science, literature, or the fine arts exclusively," &c. He adhered to what had been said in the cases referred to by counsel, and if this case could have been brought within those decisions, if the facts had resembled those referred to, the exemption could not have been claimed. But here, this was a "society instituted for purposes of science, literature, and the fine arts exclusively." It was a public library, admitting books of science, literature, and the fine arts, and there was nothing to show that any pecuniary or private advantage was in the contemplation of those who established it. The case of the Birmingham Library was good law; and this was a library containing all the standard books good for individuals and advantageous to the public. Then, was it not supported wholly or in part by voluntary contributions? This was settled by the case of the Linnæan Society, when the Court said that money paid under an obligation voluntarily incurred was a voluntary contribution. Upon the whole, his lordship thought the society was established for the purposes of science, literature, and the fine arts exclusively, and was entitled to the exemption claimed.

Mr. Justice Erle said he thought the society was entitled to the exemption, as being instituted for the purposes of science, literature, and the fine arts exclusively, and supported by voluntary contributions. The object of the Act was, that large and enlightened minds might be kept in sound and healthful action—an object which the Legislature thought might be more beneficial to a parish than the saving of a halfpenny in a pound. It was necessary that all the great faculties of the mind—memory, reason, and imagination—should be cultivated, and for these several faculties there were works of history, science, and novels. The imagination was a great faculty of the mind, which ought to be cultivated, and, therefore, there was no objection on the ground that novels and other works of imagination were introduced. In one sense a personal benefit was derived by the members, but was of a contrary nature to that referred to in the cases cited, where the subscribers had made a kind of investment of their money.

BRITISH ASSOCIATION, LEEDS, 1858.

Some Modern Appliances for Raising Water. By W. E. Carrett, Sun Foundry, Leeds.

The following Paper was read before the Mechanical Section:—

Mechanical Science and the "times" are rapidly progressing, as certain as "cause and effect." Next, perhaps to the greatest of modern inventions, the steam-engine, must rank the "Pump," in its various useful phases of quiet underworking, helping human progress in its countless manifestations, and bringing to light hidden sources of power.

Our lands want draining—their crops invigorating—and our coal-fields keeping dry, for water *will* gravitate, and we must keep pumping. If steam is to occupy the place of human power, this water must be "forced" into our boilers; and if comfort and health are to be in our our dwellings, it must be "forced" there too.

From the great Leigh-water, at Haarlem, down to the common domestic pump, there are a variety of appliances. We have "suctional" and "force" pumps, "centrifugal" and "Archimedean," "spray pumps," "percussion pumps," "wheel pumps," "chain pumps," "rotatory vibratory," and others, but the two varieties here claiming a share of attention combine both "steam-engine" and "pumps" in direct action—"power" and "work" associated agreeably, "hand-in-hand," to administer to our wants—perform the drudgery of life's necessities, and leave us more time to think and act.

The drawing shows but two combinations of the "steam-engine" and "pump;" in each case the steam cylinder is immediately over and in immediate communication with the pump beneath. A comparatively slight transposition of detail would arrange these horizontally, if required.*

The first, Fig. 1, is a "steam-pump," of the high-pressure transportable class, having a fly wheel and connecting rods to the crank shaft; and Fig. 2 is a modification of this for special cases, where lightness and portability are requisite; while Fig. 3 is a compound high and low pressure condensing "steam-engine," also in direct communication with its pump, and of much larger proportions, used as a "water-lift." Upon the two former we would first direct your attention. The object here in view is simplicity and durability of parts, a quiet and noiseless action, and, as far as possible, a superior duty effected with a minimum expenditure of power. The chief feature to be observed is, the application of the suctional and compressive air vessels in close proximity to the pumps, by which it is able to fetch the water from any distance (of course within the limits determined by friction in the pipes), or from a depth not exceeding 29 feet, and to force it any required height or distance.

The ordinary simple pump cannot do this unless at a miserably slow speed, so as to give the water sufficient "time" to be "stopped and started" throughout the entire range of the pipes at each alternate stroke.

Three common pumps, driven by a three-throw crank, will do it at a cost, but not without complication of parts and sacrifice of all "direct-action" simplicity. This resistance of the water's "inertia" against being rapidly started into motion, and the impelling influence of its "momentum" when *in* motion," have caused countless failures and disappointments in pumping schemes. To get an ample supply of water quietly and freely into and out of the pump, is not always as easy as it is desirable.

Since, therefore, the water in a long range of suctional and delivery pipes will not be stopped and started into motion in immediate accordance with the demands of a single-acting pump, but will testify its natural objection to be hurried by a series of shocks and strains, which soon impair the best machinery and clacks that can be applied; since, further, a double-action pump is little or no better, nor are we disposed to sacrifice "direct action," and apply three pumps, or to be content with one large one driven at slow speed, we must adopt a more simple and effective expedient, which, to the writer's best judgment, consists in these air-vessel appliances which enable the pump to work quietly at a speed of 110 feet per minute.

A continuous stream in the pipes is, therefore, essentially necessary.

Perhaps one practical case in point may show this clearly enough for our object. Some years since, the writer had to inspect a pair of single-acting plunger pumps, of considerable size (driven "opposite" and simultaneous) constructed to force about 150 feet high, and draw the water say 30 feet distanse and from 15 feet depth. They would not pump at all, except at a very slow speed, quite insufficient for the purpose, a few strokes beyond this; the shocks and percussion in the pumps and pipes threatened total destruction, to say nothing of the power lost. An air-vessel was suggested, and applied to the delivery side of the pump, and was expected to put all right, but it only changed the character of the evil. At each "up-stroke" the water could not follow the ram for want of "time," and when the down-stroke commenced the inlet current was about at full speed, and actually accumulated to some five to seven pounds per square inch in the suction pipes.

Another air-vessel close to the inlet of the pump at once settled all difficulties, and the action became at once noiseless and effective even at a fourfold speed. So simple was the remedy for so great an evil. And yet there are hundreds of mal-constructions to be met with everywhere, in which the pump and water are thus continually combating with each other. Turning to advantageous account this percussive action of the inertia and "momentum" of water, we have Smeaton's simple contrivance (whose birth place and remains are but a few miles from this town) the "hydraulic ram," in which the gravitating power of a body of water forces a portion of itself to a greater height; and we might further exemplify it in the shape of a "percussive action suction-pump," which would raise the water, by the joint impetus of its momentum and the pressure of the atmosphere, from a greater than the usual depth of 30 feet. In reference to our illustration, a good "single-action" plunger pump does all that is required. A is the ram, B and C the inlet and outlet clacks, D the suctional air vessel, into which the water is continally flowing, and E the compressive air vessel which regulates the equality of the discharge. F is the steam cylinder, G the crank shaft of the fly-wheel, H a frame striding this shaft, and transmitting the power of the engine to the pump. This frame is curved to the arc determined by the length of the connecting rods, and moves up and down with the piston rod, but does not touch the crank shaft passing through it. The purpose of this will be obvious.

In Fig. 2 the air vessel arrangement is disposed in two hollow columns, supporting the steam cylinder, and is suited for greater pressures where compactness and durability are essential. The same letters of reference apply to both Figs. 1 and 2. Examples of each of these can be seen in the Machinery Court of the Industrial Exhibition in this town.

We will next proceed to call your attention, as consisely as possible, to another arrangement of "water-lift" steam-pump, in which the water is not enclosed in pipes, and there is no rotative medium in the shape of a fly-wheel employed. This engine was lately constructed by us, and erected in Holland for surface drainage, to work at 5 to 15 strokes, and to raise 7,000 gallons per minute.

The steam cylinder is 25 inches in diameter, and the pump 5 feet. Now, if the cylinder here represented were of ordinary single-action construction, receiving the steam underneath the piston, and then discharging it into the atmosphere, thus effecting the "up stroke" by mere high pressure, the arrangement would be one of pretty general use for colliery purposes where cost of fuel is unimportant, but the engine here under consideration is designed to work with greater economy than can be obtained from high pressure steam only partly expanded, and afterwards "throttled out" into the atmosphere.

The cylinder A is fitted with a piston in the usual manner, but underneath, and attached to this piston, is a trunk (B) turned up and passing through the bottom of the cylinder, and working steam tight inside another cylinder (C), which, in this case, becomes the air pump.

From the bottom of this air pump a further prolongation of the rod, D, communicates motion to the bucket of the pump (which, in some cases, would be substituted by a ram).

Hence, from this disposition of parts, the effective area on the underside of the piston on which the steam is first admitted from the boiler is "annular," while the "upper side" of such piston has the full area exposed.

The position of parts here shown is such as when the pump is about to make an "up stroke;" E is the condenser, F and G the valves of the air pump, H the hot well, I a crosshead on the piston rod from which two chains pass over the wheels, J, to the balance weights K; L is the pump bucket, and M the bottom valve of the same. Steam first enters from the boiler at full pressure (say 50lbs.) beneath the annular portion of the piston, at the same time the vacuum operates on the upper a "full" area. But the high pressure steam has now only effected half its duty by this "up stroke," and is in an unfit state to be discharged into the condenser, not having parted with sufficient of its expansive power. Hence the necessity to readmit it on the "upper" or full area side of the piston, when it is further expanded down to the atmospheric pressure, or as much below as deemed advisable.

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* The author here referred to drawings.

Thus is effected in one cylinder what in the compound engine requires two, while a ready form of direct action air pump is furnished without the necessity of applying beam or radius bar. The remaining power developed by this partially expanded high pressure steam on its second admission into the steam cylinder and final expansion, is absorbed in raising the balance weights, as well as by the resistance of the water to the bucket's descent.

An adjustment of these weights regulates the speed of the down stroke and period of rest at its termination. The slide valve is a simple modification of an everyday appliance, with an additional slide on the back, and an adjustable eccentric to regulate the period of admission. This valve is driven by a small auxiliary engine, which at the same time actuates the pump for the boilers, thus avoiding the necessity of tappet and cataract arrangements of Cornish engines, and affording additional means to feed the boilers when the large engine is at rest. As the exhaust steam leaves the cylinder, it passes through a multitubular chamber, B, in its way to the condenser; around these tubes the feed-water from this boiler pump circulates. Here it takes up a considerable temperature over and above that of the hot well from whence it was pumped, and thereby enters the boilers at a temperature close upon boiling point.

The lift-pump is of simple form, which in this case is all that is necessary to act upon a great amount of surface water.

The circumference of the bucket has six arms, terminating in a central boss. Upon this rim, and supported by these arms, are three annular cast-iron perforated plates, and upon these are vulcanised India rubber rings of similar form. Each ring rises a step above the one beneath, affording a free delivery to the water, the whole being held down by the cotter which attaches the piston rod to the central boss. The bottom clack is similarly constructed, and a manhole in the pump affords access thereto.

The space N, above the top of the pump, is enclosed, to confine the discharge water to its destined course, terminating upwards at the required height of delivery. In the outlet watercourse there are sluice boards, by which the "out" water can be kept back if entrance is required to the interior of the pump.

As height of delivery and depth of suction vary according to the state of the rains, the pump, when working at its lowest head, is merely a "lift pump," but when the height of discharge increases, it then acts as a "lift and force pump," and requires but a simple adjustment of the balance weights and expansion slide to suit the altered resistance.

In the ordinary "dash-wheel" appliances for land drainage, the "out" water is often so high as to impair the effective action of the wheel, and when the "inlet" is unusually low the slip is very serious. The pump arrangement prevents this, and works advantageously at all variations in the water level.

There would be no difficulty in constructing one of these "water lifts" of ten feet diameter discharging fivefold this amount, or applying a pair working alternate strokes, in which each would balance the other, or either could be worked singly, as above described.

A few words might not have been out of place as to the comparative merits of the "centrifugal pump" and its per cent. of duty, as compared with the best form of buckets or ram pumps. A passing query shall suffice. Suppose two of the best-arranged machines for raising water to be fixed working in competition; one a "lift pump," or a "force pump," or a "lift and force pump" (their results being about the same); its opponents shall be the best "centrifugal pump;" the water to be raised over a stand column which shall be twenty feet or more, and the power for each to deliver, full duty, say 20-horse. Apply 5-horse power to each, and water will rise a consequent height in the stand column. Increase to 10 and 15-horse power, it will rise higher, but here their respective characteristics come into play. If no additional power is given, the "lift pump" will be brought to a stand by the balance of forces, and no more power can expend itself; but the "centrifugal pump" will go on, "ad libitum," without discharge. Add another 5-horse power to each, and the "lift pump" will then undoubtedly deliver its 20-horse power of duty (less friction and leakage); but in some minds there may arise a query—does the "centrifugal pump" produce alike its total 20-horse-power results?

In conclusion, the subject of our illustrations, which you have been kind enough to allow being brought before you, claims no merit beyond adaption of uncomplicated parts to the end in view. If it has been thought worthy of attention my purpose is attained. The "direct-action system" is working its way simply and quietly, and needs no defence, while its reduction of first cost is, perhaps, the most powerful inducement to its adoption.

RAILWAYS IN IRELAND.

The following is an abstract of a paper "On the Railway System in Ireland, the Government Aid afforded, and the Nature and Results of County Guarantees," read before the Institution of Civil Engineers, on the 16th instant, by Mr. G. W. Temans, M. Inst. C.E.:—

"This communication was suggested by the Address of Mr. Locke, M.P., President, in January last, which related, chiefly, to French railways. From that Address it appeared that, in 1854, the French railway shareholder received, on an average, 9 per cent.; while, on the other hand, in 1857, the English railway shareholder only obtained 3·12 per cent., or less that what was derived from money invested in the Public Funds. In the one case assistance and protection had been afforded by the Government; but in the latter, as was well known, speculation had been allowed to take its freest development. The result was, that, at the end of 1856, in England and Wales alone, with an area of 58,000 square miles, there were 6,441 miles of railway opened; but in France, with an area of 204,000 square miles, there were only 4,060 miles of railway opened; so that England and Wales were relatively 500 per cent. better furnished with railways than France, and at the same time the accommodation on the individual lines was superior. It might be assumed, however, that although the shareholders lost by competing lines and duplicate stations, the country gained; for in no case has any line been actually closed for want of traffic, or because it was valueless.

"Ireland, in 1836, was a blank, as far as regarded railways, as it possessed, at that time, only the line from Dublin to Kingstown, about six miles in length. An extract was then given, from an official document, to show the then depressed condition of the country, which resulted in the appointment, in 1836, of a Government Commission, consisting of Sir John Burgoyne, Mr. Barlow, and Mr. (now Sir) Richard Griffith, 'to inquire into the manner in which railway communications could be most advantageously promoted in Ireland.' During the labours of this commission, many Joint Stock Companies were held in abeyance. The report was finally made in July, 1838, its main recommendations being considered sound and good. It advised the construction of great leading communications, each in possession of an important district, and strongly insisted on the vital importance of protecting them from the ruinous rivalry of competing lines. The lines actually made, however, especially in the northern part of the country, were widely different from those suggested by the Commissioners, and the railway interest had suffered accordingly. There were already two trunk lines to the north, instead of one, and a third line was in contemplation. Two main lines also existed to the West, and three to the South, from Dublin. It was imagined by the Commissioners, that the lines might be made for £11,000 per mile on an average; that the receipts would amount to seventeen pounds fifteen shillings per mile per week, on the supposition that the exports amounted to 700,000 tons; that the cost of locomotive power would be two shillings and three-pence per mile, at a speed of 30 miles an hour; that the utmost profits would not exceed 3½ to 4 per cent.; that the Western line could not be attempted without ruin to the shareholders,—it had since been made, and was paying a dividend of 5 per cent;—and that the line from Newry to Dundalk was physically impossible. Although these mistakes had been made, arising from want of experience, the final recommendations of the Commission were excellent. A uniform gauge was insisted on, although the exact dimensions recommended by them were not ultimately adopted; and government was advised to advance two-thirds, or even the whole, of the capital for the construction of the leading lines, the principal and interest of such advances to be secured on local or baronial rates, in such districts as should consent so to obtain the benefit of railways. This principle had already been adopted, in Ireland, for the Shannon navigation. The report was laid before government, but as no steps were taken to carry out its recommendations, great discouragement was given to the financial success of such undertakings by private companies. In this way speculation languished for nearly six years, only two lines—the Ulster and the Dublin and Drogheda—being slowly made. When, however, the railway mania attained its height in England, it extended to Ireland, and then the country began to make for itself, and with little regard for anything like a national system, the various lines now in existence, almost all of which were originated in 1845 and 1846. But the panic arose, and subsequently the famine of 1847, which stopped enterprise for a time; and although, as an alleviating measure, the Government were strongly urged to assist Irish railways, at which period only 123 miles had been opened, the Acts having been passed for 1,500 miles, yet the proposition was rejected, and instead, the people were fed without giving any labour in return, or were employed in the mockery of useless road-making. About eight millions sterling were so expended, none of which, although originally intended as a loan, had, the author believed, ever been returned to the Imperial Treasury. Subsequently aid was given to the railways to a considerable extent, in another form. More than two millions sterling were lent to Irish companies, who had obtained Acts of Parliament, through the agency of the Public Works Loan Commission; and although the rate of interest, in most cases five per cent., was, in the author's opinion, too high, the railway system had been materially assisted and promoted, and not one bad debt had been incurred. Only one line had been executed on the principle recommended by the Commissioners in 1838, that of charging a low rate of interest, secured on the guarantee of a local rate, in aid of the profits of the line, with an additional rate, commencing ten years after the opening of the line, and payable to the company, as a sinking fund, to replace the whole amount of the loan. This exception was in favour of the Midland Great Western of Ireland, to whom a loan of five hundred thousand pounds has been granted to construct the line between Athlone and Galway. The interest was at the rate of 3½ per cent., and the sinking-fund rate of 1½ per cent. additional. In this case, the representatives of the counties of Roscommon and Galway voluntarily consented to a compulsory rate, guaranteeing to make up the difference between the profits of the line and the interest, provided the Company were compelled to construct it with the borrowed money, and to pay out of their own funds the additional 1½ per cent. as a sinking fund. The time in which the whole sum would be repaid was about thirty-five years. The author having previously constructed the line from Dublin to Mullingar, was appointed to execute the extension to Athlone and Galway, the whole length of which, 76½ miles in extent, was opened simultaneously in August, 1851, within twenty-two months from the commencement of the works. In the first half-year the deficiency of profit was only 1·4 per cent., and afterwards 1·6 per cent., instead of the whole 3½ per cent.; and in every succeeding half-year the profits had increased, until they are now fully equal to the interest payable to Government. The total sums paid by compulsory rates on the county of Galway, and the two baronies of Roscommon, had amounted to £37,414. The author thought it would be conceded that the guarantee system had in this instance proved highly beneficial; and as a further proof that this was felt to be the case, he mentioned, that since the completion of the Galway line, many attempts had been made to obtain similar guarantees for other lines, but when the Bills came before Parliament, the most determined official opposition was given to the guarantee clauses, so that only three had passed—the Killarney Junction, the Bandon and Bantry, and the Bagnalstown and Wexford,—and in these the clauses were so hampered with impossible and useless conditions, and so emasculated, that they were found to be totally inoperative. Hence the original recommendation of the Railway Commission—that lines should be guaranteed by local rates, which had been successful in the only line attempted, had not been acted upon. The system had been found to work well in France and in other Continental States, as in India and other colonies—and was frequently compelled to be adopted in the case of gas, water, roads, drainage, &c., yet it was held to be inapplicable to railways.

"At the end of 1856, there had been constructed in Ireland 1,056 miles of railway, rather more than one-half of which were single line, though the works were for double way. The cost had amounted to fourteen millions, the average per mile having been less than fifteen thousand pounds, but lately this had been reduced to from six to seven thousand pounds per mile. The average receipts were twenty-one pounds per mile per week, the dividend amounted to 4¼ per cent., nearly, and the working expenses to 39 per cent. In England, these figures were, receipts sixty pounds per mile per week, dividend 3·56 and working expenses 49 per cent. respectively; the cost per mile having reached forty thousand pounds. The favourable result here indicated was attributed to economy in construction and in working."

BRICKMAKING.

The *Ceylon Observer* contains an account of some brickmaking works recently visited by Sir Henry Ward. The works, which turn out about 20,000 bricks a day, are only six miles from Colombo. The clay for brickmaking is prepared by elephants. The wild and tame work together, and both attempt to shirk their work by endeavouring to put their feet in old footprints, instead of in the soft, tenacious, untrodden mud.

Proceedings of Institutions.

Brighton.—The twelfth half-yearly report of the London, Brighton, and South-coast Railway Literary and Scientific Institution, being from March 21st to September 29th, 1858, shows that a considerable increase has taken place in the number of members as compared with the corresponding period last year, there being now 400 members, and only 220 in 1857. Amongst the 400 there are upwards of 80 who have become annual subscribers. The Saturday evening entertainments will be continued, and arrangements are being made to render them as entertaining and attractive as possible. The circulation of books shows a steady increase as compared with the previous half-year. The following classes have commenced for the winter season:—Reading, writing, and arithmetic; mechanical drawing; mutual improvement and discussion; and dancing.

Burnley (East Lancashire Union).—On Saturday, the 31st October, the annual meeting for the distribution of prizes to the successful candidates at the examination in connection with the East Lancashire Union of Mechanics' and other Institutions, was held in the lecture hall of the Church of England Literary Institution, Burnley. In the absence of the Bishop of Manchester, who was detained at the funeral of the late Sir John Potter, the Marquis of Hartington was called upon to preside, and distribute the prizes. The bishop arrived during the distribution. There were no candidates in the first class. In the second class there were 17 candidates, eight of whom obtained prizes and certificates of merit, and two certificates only. In the first section of the third class there were 31 candidates, 10 of whom obtained prizes and certificates, and two certificates only. In this section the president awarded a volume each to four of the candidates who were otherwise unsuccessful. In the second section of the third class there were 40 candidates, of whom 28 obtained prizes and certificates, and three certificates only. Of female candidates there were seven, three of whom obtained prizes and certificates, and two certificates only. The prizes consisted of money and books. The money prize in the second class, awarded to the most deserving candidate, was £3; in the first section of the third class, £2; in the second section of this class, and in the female class, £1. After the distribution of the prizes, the noblemen and gentlemen who had been invited on the occasion proceeded to address the meeting. The Marquis of Hartington briefly referred to the advantages offered to the members of the various Institutions in Union by the scheme of competitive examinations. His lordship read an extract from a letter received from Mr. Adderley, M.P., vice-president of the Committee of Council on Education, wherein he expressed his sorrow and his inability to be present at the meeting; but to show the interest he took in the success of the union, he proposed to offer a prize to be contended for by the members of the Institutions in the Union. Viscount Goderich rose to move the first resolution:—"That the success of the candidates for prizes in the first steps of a sound English education, and the increase of the number of the candidates from 20 in 1857 to 96 in 1858, afford satisfactory evidence of the painstaking self-devotion both of the directors and pupils of the majority of the Institutions in Union." After referring to the difficulty of retaining children at school to a sufficiently advanced age for them to attain the solidly-grounded elements of knowledge, he spoke of the system of continuing their education in evening schools and other similar institutions, and he felt bound to say, after reading the report forwarded to him some time previously by his friend, Sir J. P. K. Shuttleworth, that no means, of which he had heard, seemed so likely to be successful as that they were endeavouring to apply. The Union offered means by which the various Institutes might be brought together, and their respective merits tested by fair and open competition. In going on to notice the terms of the resolution he had moved, he said he must congratulate them on the gratifying statement there made. The increase of candidates from 20 to 96 was a convincing proof that the persons for whose benefit the Union was established were more alive to its advantages. The Bishop of Manchester seconded the resolution, which was supported by the Rev. W. J. Kennedy, and passed unanimously. The Right Hon. W. Cowper, M.P., moved the second resolution:—"That the Union of the several Institutions in East Lancashire, having evening schools, has enabled them to increase their means of instruction by the appointment of organising masters and local teachers, and by the Saturday evening lectures. And that the perseverance and success of the candidates for prizes afford a hope that the institutions may, with the aid of the organising masters, be able to raise a class of candidate teachers to assist in the instruction in the evening schools." This was seconded by Mr. Jonathan Peel, and carried. The meeting was afterwards addressed by Monckton Milnes, Esq., M.P., Mr. George Foster, Mr. Brooks, and Mr. F. Ecroyd.

Dorking.—The first annual meeting of the Literary and Scientific Institute was held in the large room of the Institute, on Tuesday, October 5th,—Mr. A. K. Barclay presided. Among those present also were Mr. C. Ellison, Mr. G. Cubitt, Col. Grissell, Mr. S. Highley, Mr. D. Matheson, Mr. C. Hart, Capt. Atcheson, Rev. Mr. Calvert, Rev. H. Seymour, Rev. J. O. Whitehouse, Mr. G. Arbuthnot, &c. The Chairman, in opening the business of the day, spoke of the excellent position of the society and its favourable prospects for the ensuing year. He warmly congratulated the society upon the prospect of having lectures delivered of a really intellectual character, and he was glad to see that it took a really scientific turn, as well as being an Institution of a literary character.—Mr. Durant, hon. sec., then read the report, which shows the financial position of the Institution to be favourable. The number of members has been increased upwards of 100, comprising 22 vice-presidents, 55 honorary, and 31 ordinary and junior members. The library actually possessed by the Institution is of course limited, but arrangements have been entered into with Messrs. Booth's library, and subsequently with that of Mr. Mudie, for a supply of standard works and of the latest contributions to general literature. The committee speak of the valuable and timely aid which the Society has received at the hands of Mr. Samuel Highley, one of the newly-elected vice-presidents, who has lent for the use of the Institution a most complete and costly laboratory, including a great number of instruments and specimens suitable for preparing or illustrating lectures on natural philosophy, chemistry, and natural history; and the committee have resolved on the formation of a museum, devoted to the exhibition of objects of local interest; and, in consideration of the services and ability of Mr. Highley, have determined upon conferring upon him the office of honorary director of the Laboratory and Museum. The committee hope that immediate steps will be taken for organising a series of lectures on literature and science during the approaching winter.—Mr. G. Browne, the treasurer, then read the financial statement, from which it appeared that the receipts amounted to £149 7s.; the expenditure to £109 15s. 8d.; leaving a balance of £39 14s. 4d. in favour of the Institution. The election of officers for the ensuing year then took place, and after some discussion in reference to the subject of evening lectures, several votes of thanks were passed and the meeting separated.

Queenshead (near Bradford).—The fifth annual meeting of the members of the Black Dike Mills Literary and Scientific Institution was held on Tuesday evening, the 5th ult., in the large class-room. The business was opened with a brief address by the chairman, A. B. Foster, Esq., president; at the conclusion of which he called upon the secretary, Mr. George Turner, to read the report of the directors. In this the Committee regret to state that there has been a considerable falling off in many branches of the Institution. The number of subscribers, as compared with the previous year, stands as follows:—

	This Year.		Last Year.	
	Males.	Females.	Males.	Females.
1st Quarter	143	22	137	18
2nd ,,	127	18	135	10
3rd ,,	104	9	121	17
4th ,,	89	5	100	8

Shewing an average of 129 subscribers, and a reduction of eight from the previous year. The average attendance at the male classes during the winter months was 53, against 57 in the previous corresponding period, exhibiting a slight decrease; but, during the summer months, the average number in attendance was 37, whilst in 1857 it was only 34. The female classes have been again continued throughout the year, with an average attendance of 16, whilst last year's was only 12. These classes have, however, upon the whole, not received that support which might have been expected. The bye-law is still in force allowing subscribers not attending the classes themselves to nominate any individual employed by Messrs. Foster and Son to do so in their stead without extra charge. 29 have been so nominated this year, and in the last 27, which shows that the privilege continues to be duly appreciated. It is to be hoped that a much greater number of subscribers than hitherto will avail themselves of the opportunity thus afforded of assisting deserving youths of both sexes to improve their earlier education. The drawing class established last year, which was only continued during the winter season, consisted of 15 members, and it is proposed to resume it in the present session. Seventeen volumes have been added to the library during the year, making the total number 769. There have been 2,651 books and 264 periodicals issued during the year. This exhibits a considerable decrease, as last year the the issues were 3,256 books and 239 periodicals. The subscriptions for the year amount to £38 15s. 6d., and further sums received for the concert, lectures, &c., to £37 6s. 4d., making a total of £76 1s. 10d., which has not covered the expenditnre by £1 8s. 11d.; this added to the balance of £5 17s. 6½d., due to the treasurer last year, makes a deficiency of £7 6s. 5½d. up to the present time. The annual concert was in November last, when a profit of £2 17s. 8d. was raised, besides admitting subscribers at half-price. Two lectures also have been given during the year, one by Mr. Blake, on "China and the Chinese," and the other by Mr. Vincent, on "Our Young Men and Women." The attendance at these lectures was, however, not so encouraging as the committee had expected. The cash account for the past year was read by the treasurer, Mr. James Briggs, and the various topics alluded to in the former document, more particularly the classes for females, as well as other matters affecting the welfare of the Institution, were discussed; and, judging from the remarks made, there is reason to believe that a better feeling towards the Institution will be manifested. The officers, directors, and librarians were then elected. Votes of thanks for their services were unanimously passed to the late officers and librarians. A similar vote, accompanied by hearty cheers, was passed to Messrs. Foster and Son, for gratuitously furnishing the necessary rooms, furniture, fires, and gas. From some remarks made near the close of the meeting, it seems not improbable that the Institution will be removed to larger, handsomer, and a more convenient suite of rooms before the next annual meeting.

WITHAM (LITERARY INSTITUTION). — On Tuesday evening, the 26th October, the annual meeting of the members and supporters of this Institution was held in the Lecture Hall, Captain Luard, R.N., in the chair. On the platform were the Rev. Sir John Page Wood, Bart.; Rev. J. Bramston; J. H. Pattison, Esq.; Rev. B. D. Hawkins, Rev. J. Goodday, Rev. R. T. Crawley, Mr. W. Butler, Mr. G, Wilkinson, &c. There was a very full attendance. Captain Luard, R.N., as chairman, in opening the business, said he felt strongly the benefit arising from such an Institution if liberally supported and well attended, and the desirability of embracing any good cause that would bring the different classes of society together. After speaking of the progress of knowledge and invention, and particularly of the advantages afforded by such Institutions as this for obtaining acquaintance with the events of the day, as well as for the general purposes of study, the chairman expressed his belief that their rooms would not accommodate a sufficient number of the public to defray the expenses of a lecturer, and he thought the growing requirements of the Institution demanded a greater space. He trusted, therefore, that in Witham they might find sufficient public spirit to raise funds for an entire new building. He was happy to inform them that their president Lord Rayleigh, their vice-president Mr. Ducane, and Mr. Sutton Western, had given them their sanction and support in the event of such an undertaking being commenced, and he had no doubt they should not appeal in vain to the surrounding neighbourhood. But supposing all the gentry of the county came forward to assist in the erection of a new building, it would be insufficient unless they obtained the permanent support of all classes.—Mr. Wilkinson, the secretary, read the fourteenth annual report, from which it appeared that sixty new members had joined, the subscription-list being better filled than at any former period, and the members, including the honorary and life members, numbering nearly 200. The issue of books had reached to 2,600, or 400 more than at any previous period. Three musical entertainments would be remembered with great pleasure, and much instruction had been derived from the gratuitous lectures of Lorraine Estride, Esq., Rev. J. Goodday, and Rev. T. D. Bernard, to whom their gratitude was due. The library had been increased by 100 new books, 45 consisting of a complete set of the Waverley novels; and the grand pianoforte on the platform was liberally subscribed for by the ladies of Witham. The report concluded by expressing a hope that the members would cordially unite with the committee, so that a long-continued course of prosperity and usefulness might attend the Institution. Mr. Butler, the treasurer, having read a brief but satisfactory financial statement, and the reports being unanimously passed, the chairman announced that he believed an old and staunch supporter of the Institution was ready to present them with a piece of ground on which to erect a new building, and he begged to propose that the committee be requested to take into consideration the best means for raising funds to erect the new building. The Rev. Sir John Page Wood, Bart., in seconding the resolution, said that all Institutions, to flourish, should be self-supporting, otherwise they would fall to the ground. He therefore suggested, for the consideration of the committee, in order to make the Institution self-supporting, to enrol every member as a shareholder in the property about to be erected. On the motion of Mr. Foster, seconded by Mr. W. E. Smith, the president and vice-presidents were re-elected, and Captain Luard, R.N., was elected a vice-president. The election of the committee for the ensuing year then took place. The Rev. J. Bramston moved, "That the thanks of the society be presented to the ladies who subscribed liberally for the purchase of a pianoforte, and to several gentlemen for gratuitous presentation of newspapers."—J. H. Pattison, Esq., seconded the resolution, which was passed; and thanks having been voted to the chairman, the meeting separated.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Geographical, at Burlington House, 8½. I. "Notes, Geographical and Commercial, on the Gulf of Pecheli and the Peiho River," by Capt. Sherard Osborn. II. "Leichhardt and the Australian Desert," by the Rev. W. B. Clark.
London Institution, 7. Prof. Tyndall, "On Light."
Tues. ......Civil Engineers, 8. Discussion on "The Railway System in Ireland." And, if time permits, Mr. T. S. Isaac, "On the Successful Operation by Locomotive Power, over Gradients of 1 in 17 and Curves of 300 feet radius on Inclines in America."
Med. and Chirurg., 8½.
Zoological, 9.
Wed. ......Society of Arts, 8. Mr. F. Joubert, "On a Method of rendering Engraved Copper-Plates capable of Producing a greatly-increased Number of Impressions."
London Institution, 3. Mr. T. R. Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Thurs......London Institution, 7. Dr. E. Frankland, "On the Air and Water of Towns."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 12, 1858.]

Dated 1*st September*, 1858.

1988; A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of alumina. (A com.)

Dated 12*th October*, 1858.

2270. L. Wray, 5, Devonshire-street, Portland-place—New and improved compounds for the coating or insulating of submarine electric telegraph wires, and which are also applicable to the coating or insulating of electric telegraph wires laid underground.

Dated 14*th October*, 1858.

2290. J. R. Smith, Glasgow—Imp. in apparatus for propelling boats and vessels.
2292. W. Clark, 53, Chancery-lane—Imp. in tanning hides and in apparatus employed therein. (A com.)

Dated 16*th October*, 1858.

2312. J. P. Gillard, Paris—Imp. in generating hydrogen, and in the means of, and apparatus for, applying the same to heating and lighting purposes.

Dated 19*th October*, 1858.

2336. W. Gossage, Widnes, Lancashire—Imp. in the utilization of alkali waste.

Dated 26*th October*, 1858.

2385. A. V. Newton, 66, Chancery-lane—Improved machinery for pulverizing, kneading, pressing, and moulding clay and other plastic materials. (A com.)

Dated 27*th October*, 1858.

2387. B. Goodfellow, Hyde, Chester—Certain imp. in steam engines.
2388. J. Luis, 1B, Welbeck-street, Cavendish-square—A new syphon water-wheel, receiving its water without destroying the water level. (A com.)
2389. J. Luis, 1B, Welbeck-street, Cavendish-square—A new machine for boring. (A com.)
2390. J. Bleakley, Accrington, Lancashire—Imp. in boilers, flues, and the methods of fixing the same.
2391. A. P. A. Beau, 152, Regent-street, London—A pocket stereoscope.
2392. J. Kinsey, Brighton—Imp. in steam engines and pumps.
2393. C. Cheyne, Great George-street, Westminster—Imp. in the construction of floors and ceilings.
2395. G. Speight, 19, Woodbridge-street, Clerkenwell—Improved plaits and curls or ringlets for head-dresses or ornaments or additions to the natural hair, and an improved apparatus for the manufacture of curls or ringlets.
2396. M. Mason, Manchester—Imp. in letter-press printing machines.
2397. P. G. Gardiner, New York—Furnaces for reheating steel, preparatory to hardening, tempering, or annealing.
2398. T. Almond, 22, Pickering-place, Paddington—Imp. in furnaces for the better combustion of smoke.
2399. J. W. Mott, Lea Bridge-road—Imp. in pouches of india rubber for holding tobacco or other substances.

Dated 28*th October*, 1858.

2400. D. Varley, Over Darwen, Lancashire—"An improved picker for looms.
2401. G. M. Casentini and J. O. Barnard, Hercules-buildings, Lambeth—A certain composition to be used in the manufacture of articles composed of or made with plaster of Paris and other similar substances.
2402. P. G. Gardiner, New York—A new and useful apparatus for cooling and preserving an equable and low temperature in the oil or composition, or other fluid mixture used for the purposes of tempering, annealing, or hardening steel.
2403. J. Westerby, Upper Aspley, Huddersfield—An improved application of steam to vessels filled with oil, tallow, or other materials for lubricating the cylinders of steam engines of high or low pressure.
2404. C. Pooley, Manchester—Certain imps. in and applicable to carding engines and other machines for preparing cotton and other fibrous materials.
2405. T. Railton, Manchester—Imps. in the apparatus employed in the manufacture of cap or bonnet fronts.
2406. A. Heywood, Manchester—Imp. in machinery or apparatus for suspending paper and woven fabrics to be dried. (A com.)
2407. J. Evans, Brewers' House, Nine Elms, Battersea—Imp. in lubricating the slide valves and pistons of steam engines and in apparatus for this purpose.
2408. B. Foster, Denholme, near Bradford, and P. Smith, Keighley—Imp. in machinery or apparatus for spinning and doubling wool, alpaca, mohair, cotton, silk, flax, and other fibrous substances.
2409. W. Munro, 32, Bartholomew-close—A new manufacture of capsules and other metallic articles.
2410. J. Smith, Bristol—Improved hats and coverings for the head.
2411. W. Hall and A. Wells, Erith—Imp. in electric telegraph cables, and in machinery employed in the manufacture thereof.

Dated 29*th October*, 1858.

2412. P. Brunon, Paris—An improved mode of manufacturing cocks.
2413. W. Kirrage, 10, Goulstone-buildings, Bermondsey New-road—An improved elastic combination of materials impervious to atmospheric influences, as a substitute for hard woods, metal, leather, or felting, and for other purposes.
2414. J. Dransfield, Water Head Mill, Oldham—Certain imp. in cocks, taps, or valves.
2415. P. Wright, Dudley, Worcestershire—Imp. in the manufacture of anvils.
2416. W. E. Newton, 66, Chancery-lane—An improved method of attaching wheels to the axles of railway carriages. (A com.)
2417. J. Dixon, Jersey City, U.S.—A method of manufacturing steel.
2418. J. Wright, 21, Bridge-street, Blackfriars—An improved application of machinery, to be used as a new motive propelling power. (A com.)
2419. G. Zanni, Union-street, Barnet—Imp. in arranging magneto-electric machines for medical and other purposes.
2420. R. W. Chandler, Bow, and T. O. Hatfield, Hertfordshire—Imp. in agricultural apparatuses for ploughing and otherwise operating upon land.
2421. R. A. Brooman, 166, Fleet-street—Imp. in obtaining motive power. (A com.)
2422. L. J. Lewis, New Bridge-street, Birmingham—Certain imp. in fastenings for ladies' dresses and other such like purposes, as also in the machinery for manufacturing the same.
2423. J. Morris, Broughton, Salford, Lancashire—Imp. in the manufacture of rollers or cylinders for printing fabrics.
2424. J. Drummond, Midlothian, N.B.—Imp. in reaping and mowing machines.
2425. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in photography, and in the apparatus connected therewith. (A com.)

Dated 30*th October*, 1858.

2426. R. J. Coningsby, London—Improved apparatus for turning over the leaves of music or of books.
2427. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus to prevent railway accidents. (A com.)

Dated 1*st November*, 1958.

2429. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in machinery for weaving velvets and other piled fabrics. (A com.)
2431. H. H. Henson and W. F. Henson, 38, Parliament-street—Imp. in the manufacture and treatment of starch for domestic purposes.
2433. J, Cariss, York—An improved safety switch-box and gear.
2435. C. Perley, New York, U.S.—Certain improved means for disconnecting boats from the davit blocks, and effecting other like objects.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 16, 1858.]

November 16*th.*

682. M. Duce.
1092. J. H. Johnson.
1094. J. and W. Allen.
1097. W. H. Bagnall.
1098. W. Raymond.
1099. C. W. Harrison.
1103. R. Imeary and T. Richardson.
1108. E. C. Brochand.
1111. J. Brown.
1113. W. MacNaught and W. R. Critchley.
1120. W. Clark.
1135. J. Apperly & W. Clissold.
1141. J. Ronald.
1147. J. H. Johnson.
1157. M. Stevens.
1176. J. Luis.
1209. E., R., and P. Sykes.
1228. A. Barchou.
1244. J. Meikiejon.
1286. R. Wappenstein.
1294. J. Rawlings.
1298. D. Moseley.
1310. C. Cammell.
1311. J. Roberts.
1339. A. F. Newton.
1352. Baron Ferdinand Julius of Wedel-Jarlsberg.
1414. S. Barlow.
1523. J. Holland and F. Potts.
1677. J. Cooke.
1706. J. Miles.
1903. M. Benson.
1944. F. J. Evans.
1989. W. E. Newton.
2101. E. Welch and J. Biggs.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Nov.* 12, 1858.]

November 8*th.*

2519. C. Whipple.

November 10*th.*

2534. H. Wickens.
540. G. Cooke.
2581. G. T. Bousfield.

[*From Gazette, Nov.* 16, 1858.]

November 13*th.*

2535. W. Crosley.
2553. J. Wilkinson, senr., and J. Wilkinson, junr.
2645. J. Jobson.
2653. C. Sanderson.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 26, 1858.

SECOND ORDINARY MEETING.

Wednesday, Nov. 24, 1858.

The Second Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 24th inst., George T. Doo, Esq., R.A., F.R.S., in the chair.

Previous to the reading of the Paper, the Secretary called attention to some specimens of printing on veneers, for decorative purposes, exhibited by Mr. William Taylor, of Nottingham. The veneers are cut from a log, which revolves against a knife, by means of which a continuous sheet of wood, of considerable width, is obtained. When cut they are stated to require no planing; a much smaller portion of glue is necessary to mount them, and, after being made smooth with fine glass-paper, they are ready for French-polishing. These veneers are afterwards ornamented with designs printed by a lithographic or other surface-printing process, either in black or colours, so as to produce the effect of marqueterie and other kinds of inlaid work. Attention was also drawn to two paintings on glass, by Signor Agneni. The pictures are produced on the under surface of the glass, the remaining portion being silvered in the ordinary manner employed for mirrors; they are intended to be used for decorating the walls of rooms.

The Paper read was—

ON A METHOD OF RENDERING ENGRAVED COPPER-PLATES CAPABLE OF PRODUCING A GREATLY-INCREASED NUMBER OF IMPRESSIONS.

By F. Joubert.

The art of representing objects by means of outlines cut into solid stone or metal, appears to have been practised from the remotest antiquity; the Nineveh inscriptions recently brought to light, the numerous monuments left by the Egyptians, their vases of gold and other metals, covered as they are with a variety of inscriptions and designs cut in deep intaglios, sufficiently prove the fact.

We have also the positive knowledge that precious metals, even steel, were frequently engraved upon by the Arabs, long before their civilization penetrated into Europe; their arms especially, and many splendid pieces of armour bearing elaborately cut designs and ornaments, are evidence of this. The Greeks, and in after times the Romans, practised the art of engraving on stone and metal extensively. Gem or precious stone engraving, to the origin of which it is difficult to assign a period, was cultivated by the Romans with a degree of perfection which has never been surpassed.

At a later date, the skill of the goldsmiths of the middle ages had introduced the practice of covering vases and cups of gold and silver with a great many ornaments, even portraits, cut into the metal in deep lines or ridges, which were afterwards filled up carefully with other metals in a state of fusion, so as to render them perfectly adherent. When the metal had cooled, the whole surface was submitted to a high polish, and displayed the ornaments in various tints of metal; sometimes a sort of black composition only was poured into the lines while in a liquid state, which soon hardened and answered the same purpose as metal. This process, then much in vogue in Italy, was called "niello," and when we are told that it was customary to take a rude impression, in clay or wax, of the work just completed, by means of some lamp black rubbed into the lines, in order to judge of the effect before resorting to the process of nielling, it is difficult to imagine that the discovery of the means of obtaining a more permanent impression should not have taken place earlier.

Before examining with the attention it deserves the development of this great discovery, perhaps it may not be out of place to offer a few general remarks.

When the different nations of the continent, especially Italy, were awakening to the new order of ideas which was shortly to inaugurate the splendid period which has been called "The Renaissance," when the thirst for learning and the desire for the possession of books, in those days scarce, and only to be had in manuscript, was such that men of great celebrity and erudition, Boccaccio amongst the number, could devote much valuable time in copying out whole volumes of the Latin authors—then, by an admirable order of Providence, who dispenses to us all gifts at the precise time that we are ready to receive them, the invention of the art of type-printing took place to supply the want generally felt, and books began to be diffused extensively.

In like manner, when the taste for pictures or for a representation in some shape or other of a design was steadily growing in the public mind, compositions and subjects, drawn firstly on a piece of hard wood, were carved out so as to show, in relief, the surface only, which had been delineated with the pencil or the pen, and by rubbing some black substance over the compositions thus standing in relief, and pressing heavily a piece of paper spread over it with the palm of the hand, something like an impression was obtained; yet, this means of reproduction from the wood block had not suggested the idea that intaglios cut into a plate of metal were capable also of yielding an impression, when an accident led to the discovery of a process, the value of which it is not easy to overestimate, considering the immense development the invention has received.

There is no possibility of dispute as to the date of the invention attributed to Tomaso Finiguerra, the Florentine goldsmith: the little print, extremely rare, whch can be seen at the Imperial Library, at Paris, bearing the inscription "1452," and supposed to be the oldest print from a metal plate now in existence, disposes of this point; the manner also in which the discovery took place is known. Finiguerra, having completed some elaborate piece of engraving on silver, had filled the intaglios with a black composition in a soft state, and after cleaning out carefully the surface of the metal so as to leave the black only in the engraved part, he had occasion to absent himself from the workshop for a short time; a girl passing through the room with some wet clothes chanced to let fall a piece of wet linen on the very work that was lying on the table. When Finiguerra, on his return, lifted up the linen, he perceived, to his great amazement, a perfect impression of the ornaments he had been engraving transferred to this piece of linen. A world of new ideas was at once opened to his mind; he tried to accomplish designedly that which had been the result of accident, and, after a great many attempts, succeeded in producing a correct impression on *wet paper*.

Such an important discovery could not remain long secret; several artists of that time tried their hand at the new art, and a few years later, in 1477, the first book containing impressions from engraving on metal was published at Florence.

The art of engraving was practised with success in many places from that early period, and especially at Rome, where a celebrated artist, Andrea Mantegna, already known from his numerous pictures, many of which have been transmitted to us, took up the burin, and in translating his own works on copper, produced those admirable plates in which the talent of the painter is combined with that of the engraver.

In Germany, also, Martin Schoen published, as early as 1460, his first prints, and was long considered by his friends and contemporaries as the inventor of the art; his disciples and imitators were many; the art was likewise practised at Munich, at Nuremberg, in which last place Albert Durer, from a very early age, had shown such a natural taste for the culture of the fine arts that his father, a goldsmith by trade, allowed him to leave his workshop for the studio of Michael Wohlgemuth, where he learned to paint and engrave, and soon made rapid progress. He began by copying the compositions of his master, but soon engraved from his own designs with surprising success.

The reputation of Albert Durer had already extended far, when he married, in 1494, but his domestic life was far from being a happy one, and from time to time, in order to escape from his family troubles, he undertook several journeys, once to Holland, where he was received as a brother by Lucas, of Leyde, who was a great admirer of his works; another time he went to Venice, where, to his great mortification he found that spurious copies of his own works were publicly sold, bearing his own signature or monogram; Albert Durer traced out the unprincipled individual who was practising the fraud, lodged a complaint before the tribunal and he was punished. His name was Marc Antonio.

A few years later, in testimony of the high esteem in which he held Albert Durer, Raphael sent him a present of a series of prints, which the illustrious artist had had executed from his own compositions, and under his immediate direction by the same Marc Antonio, whose name had already become celebrated.

Marc Antonio, born at Bologna, had spent his early years in a goldsmith's shop, when he was offered an engagement to go to Venice and work for a goldsmith and engraver of that place; he there had occasion to see some impressions of Albert Durer's engravings, which perfectly astonished him; not satisfied with copying those for improvement, he soon went even further, for, as we have seen, he was detected by Albert Durer himself, in passing off and selling his own copies for the originals.

Soon after this, Marc Antonio went to Rome, where he was introduced by Giulio Romano to Raphael, who was so pleased with his talent as an engraver that he gave him some of his compositions to translate on copper. Marc Antonio's works have never been superseded, and to this day are held in high repute by all lovers of true art. He had a considerable number of pupils from all parts of the continent, and, although the death of Raphael caused a temporary check in his career, by putting a stop to the extensive works he was engaged upon from Raphael's compositions, yet, under the guidance of Giulio Romano, he published many fine works, but after a very checkered life, having resorted to his former practice of copying and signing a composition which was not his own, the rightful proprietor of the plate, instead of imitating Albert Durer, and applying for redress to the courts of law, sought Marc Antonio, and, running him through the body, killed him on the spot.

In Holland and Flanders, Lucas of Leyden, and soon after Wosterman, Pontius, and Bolswert, published numerous engravings, the reputation of which was, for a time, almost superseded by the great success of Rembrandt's etchings, which success the lapse of two centuries has not in any way diminished.

In France, the art of engraving, which, for many years, had made no progress, seemed to receive a fresh impulse from the talent of Jacques Callot, whose admirable etchings are well-known, and also from the etchings and engravings of Claude Lorrain, Poussin, Lesueur, and Valentin.

In England, with the exception of Hollar, there is scarcely any name of note to be mentioned, although engraving was much cultivated, especially by foreign engravers, and Hollar, after having published a vast number of engravings, chiefly illustrating books, died at the age of sixty.

The last century produced many engravers of great merit, and in this country foremost amongst them are Hogarth, Sir Robert Strange, and James Heath. The excellence of their works gave rise to such a demand for print impressions of engravings, that some forty years ago, when it was found that a copper plate could not yield a sufficient number of impressions for the demand, steel plates were introduced, for small plates only at first, and several editions of books were published containing plates most elaborately engraved on steel.

Subsequently, when means were found to obtain a large surface of steel of pure quality, this metal was adopted for the style of engraving known as mezzotinto, which is now practised on steel plates, the result being a much larger number of impressions obtainable as compared with the old copper plates; but historical or line engraving for important subjects was still entirely practised on copper, when the discovery of the art of electroyping took place, towards the year 1838.

Several line engravings on copper were then multiplied by this process; the result, however, was only attended with partial success, in consequence of the soft quality of the copper so deposited, which will yield but a very limited number of good impressions, and soon wears away; this caused the process to be almost abandoned for artistic engraving, but for commercial purposes it is still practised extensively, and has been often successfully applied in cases where a large number of impressions is not required.

Under the circumstances which I have described, it had become a desideratum to harden, if possible, the surface of a copper plate, and to protect it from wear while printing, but it is only lately that this important object has been attained.

In March last my friend M. Jacquin, of Paris, took out a patent in this country for a method of coating plates with iron, which had already been successfully applied in France, and of which the merit is due to my friend, M. Henri Garnier, of Paris.

I have myself had the advantage of co-operating with M. Garnier in the development of the invention, the principles of which I shall now proceed to describe:—

If the two wires of a galvanic battery be plunged separately into a solution of iron, having ammonia for its basis, the wire of the positive pole is immediately acted upon, while that of the negative pole receives a deposit of the metal of the solution—this is the principle of the process which we have named "acierage."

The operation takes place in this way:—By placing at the positive pole a plate or sheet of iron, and immersing it in a proper iron solution, the metal will be dissolved under the action of the battery, and will form hydrochlorate of iron, which, being combined with the hydrochlorate of ammonia of the solution, will become a bichloride of ammonia and iron; if a copper plate be placed at the opposite pole and likewise immersed, the solution being properly saturated, a deposit of iron, bright and perfectly smooth, is thrown upon the copper-plate, from this principle:—

Water being composed of hydrogen and oxygen;

Sal ammoniac being composed of

1st. Hydrochloric acid containing chlorine and hydrogen;

2nd. Ammonia, containing hydrogen, nitrogen, and oxygen;

The water is decomposed under the galvanic action, and the oxygen fixes itself on the iron plate, forming an oxide of iron; the hydrochloric acid of the solution acting upon this oxide forms a hydrochlorate of iron, whilst the hydrogen precipitates itself upon the plate of the negative pole, and, unable to combine with it, comes up to the surface of the solution in bubbles.

My invention has for its object certain means of preparing printing surfaces, whether for intaglio or surface printing, so as to give them the property of yielding a considerably greater number of impressions than they are capable of doing in their ordinary or natural state. And the invention consists in covering the printing surfaces, whether intaglio or relief, and whether of copper or other soft metal, with a very thin and uniform coating of iron, by means of electro-metallurgical processes. The invention is applicable whether the device to be printed from be produced by engraving by hand, or by machinery, or by chemical means, and whether the surface printed from be the original or an electrotype surface produced therefrom. I would remark that I am aware that it has been before proposed to coat type and stereotypes with a coating of copper, to enable their surfaces to print a larger number of impressions than they otherwise would do; I therefore lay no claim to the general application of a coating of harder metal on to the surface of a softer one, but my claim to invention is confined to the application of a coating of iron by means of electricity on to copper and other metallic printing surfaces.

In carrying out the invention the solutions of iron employed may be varied, and such is the case in respect to the arrangement of the galvanic battery or other source of electric currents used; I do not therefore limit the invention to the means herein-after described, but I believe they will be found to be the best for the purpose.

I would further remark that it is important that a ferric solution should be employed which will not dissolve or corrode the plate intended to be coated, for if it be attempted to use such a solution, though the iron will be precipitated, it will not only be in a non-coherent state, but the engraved surface itself will be liable to be attacked and injured. It may also be remarked that the coating of iron admits of being removed from a printing surface of copper without injury to the original plate, hence the original plate may, after being coated and used for some time, have the worn coating removed, and then be re-covered with an iron coating as often as may be required; and if care is taken to remove the coating of iron before it has been entirely worn away, the engraved copper or other plate may be made to print a vast number of impressions and yet remain in the original state it was in when it left the hands of the engraver, or was otherwise first produced; the only limit appears to be in the gradual change which takes place in the body of the printing surface by the compression to which it is subjected in the process of printing. Heretofore, in respect to plates engraved in intaglio, if of steel, they each yield on the average about 3000 impressions without retouching; if of copper they each yield on an average not more than 800 without retouching; whilst electro casts of copper obtained from the originals will not on an average each yield even 200 impressions without retouching; in fact such printing surfaces are so easily worn, that after the first hundred or 150 impressions there is a considerable deterioration in the quality of the work produced. Therefore, for the supply of the number of impressions often required by art associations and others, it has been found necessary to multiply the electro casts very considerably. In such cases the invention is applicable with considerable advantage, for I find that an electro plate 40×22 inches covered or coated with iron has yielded 2000 impressions without its being necessary to remove and renew the iron coating, there being no perceptible difference between the first and last impression, the work on the plate appearing not to have suffered in the slightest degree. Hence in future, by the application of the invention, it will only be necessary to multiply electro casts to such an extent as may be necessary to ensure the production of prints or impressions with the requisite speed on paper, calico, or other fabrics. At the same time an original engraving on copper would become, when treated according to the invention, more lasting than if engraved on steel. Although original surfaces engraved in relief, and also electro and other casts taken from them, yield a considerably greater number of impressions than those I have mentioned as obtained from plates engraved in intaglio, to which the invention has not been applied, nevertheless the invention is applicable with great advantage to such relief printing surfaces, whether of copper or other soft metal, for if they be coated with iron according to the invention they will yield almost an indefinite number of impressions, provided the iron surface be renewed as often as may be necessary, and the printing surfaces be again re-coated.

In carrying out the invention I prefer to use that modification of Grove's battery known as Bunsen's, and I do so because it is desirable to have what is called an intensity arrangement. The trough I use for containing the solution of iron in which the engraved printing surface is to be immersed in order to be coated is lined with gutta percha, and it is 45 inches long, 22 inches wide, and 32 inches deep. In proceeding to prepare for work, the trough, whether of the size above mentioned or otherwise, is filled with water in combination with hydrochlorate of ammonia (sal ammoniac) in the proportion of one thousand lbs. by weight of water to one hundred lbs. of hydrochlorate of ammonia. A plate of sheet iron, nearly as long and as deep as the trough, is attached to the positive pole of the battery and immersed in the solution. Another plate of sheet iron, about half the size of the other, is attached to the negative pole of the battery, and immersed in the solution, and when the solution has arrived at the proper condition, which will require several days, the plate of iron attached to the negative pole is removed, and the printing surface to be coated is attached to such pole, and then immersed in the bath till the required coating of iron is obtained thereto. If, on immersing the copper plate in the solution, it be not immediately coated with a bright coating of iron all over, the bath is not in a proper condition, and the copper plate is to be removed and the iron plate attached and returned into the solution. The time occupied in obtaining a proper coating of iron to a printing surface varies from a variety of causes, but a workman after some experience and by careful attention will readily know when to remove the plate from the solution; and it is desirable to state that a copper plate should not be allowed to remain in the bath and attached to the negative pole of the battery after the bright coating of iron begins to show a blackish appearance at the edges. Immediately on taking a copper plate from the bath great care is to be observed in washing off the solution from all parts, and this I believe may be most conveniently done by causing jets of water forcibly to strike against all parts of the surface. The plate is then dried and washed with spirits of turpentine, when it is ready for being printed from in the ordinary manner.

If an engraved copper plate be prepared by this process, instead of a comparatively limited number of impressions being obtained and the plate wearing out gradually, a very large number can be printed off without any sign of wear in the plate, the iron coating protecting it effectually; the operation of coating can be repeated as many times as required, so that an almost unlimited number of impressions can be obtained from one plate, and that a copper one.

This process will be found extremely valuable for electrotype plates and also for photogalvanic plates, since they can be so protected as to acquire the durability of steel, and more so, for a steel plate will require repairing from time to time, these will not, but simply recoating whenever it is found necessary; by these means one electro copper plate has yielded more than 12,000 impressions, and was found quite unimpaired when examined minutely.

It is easy to appreciate the importance of this invention as applied to artistic or line engraving more especially, for a copper plate being once engraved, if submitted to the acierage process, will become a lasting property, not liable to deterioration by printing, and the public may expect to be supplied with the very best impressions at a more moderate charge, whilst to the numerous branches of commercial engraving, for the ceramic manufactures and others, as well as to the vast number of old engraved copper plates existing in this country, this process is likely to confer an immense additional value.

I need not say that copper is by no means the only metal to which the process is applicable, for the same principle will be found to answer in the case of other soft metals used for printing purposes, and I shall only add, in conclusion, that although the principle of electrotyping has been applied up to the present date in a variety of ways since it was organized by Thomas Spencer, in 1837, this is, I believe, the first time that an attempt has been successfully made to prepare an engraved copper plate with harder metal, with the view of increasing its printing capabilities, and I feel happy to have been the first to introduce so valuable a discovery into this, my adopted country.

DISCUSSION.

Mr. George Godwin, F.R.S., had listened with great pleasure to Mr. Joubert's paper, as no doubt all present had done. The introductory portion of it brought to his mind that admirable collection of engravings which was exhibited last year at Manchester, wherein the progress of the art was so well shown, and he could not but express a hope that the authorities of the British Museum would do that which had long been urged upon them, viz., provide proper apartments in which might be exhibited specimens of the English school of engraving, which was so worthily represented by the Chairman and other gentlemen whom he saw there that evening. Passing to the more practical points of the paper, he would remark, in the first place, that he thought it ought not to be inferred that steel was only used in the present day for small plates. He believed it was also extensively used for large engravings, although the engraver would probably be glad to get rid of this metal and return to the use of the softer material, copper, if a sufficiently large number of impressions could be taken from it, and this was the great point to be considered in estimating the value of the invention before them. He did not think Mr. Joubert was quite right in attributing the failure of the electrotype process to the softness of the electrotype plates. It was stated by Mr. M'Queen, in his evidence before a Committee of the House of Commons, that the electrotype plates gave as many impressions as the original copper plate itself. The Council of the Art Union of London had adopted the electrotype process at a very early period of its introduction, and, in some cases, with perfect success. For instance, in the case of the plate of Raphael and the Fornarina, engraved by Lumb Stocks, there were fourteen electrotype plates taken from it, which produced 14,000 successful impressions. He believed 1,100 impressions was the maximum taken from any one of these electrotype plates, which was a very large number; it was true that some touching of the plates was required. He believed that was as large a number as could be taken from the original plate. The point he wished more particularly to dwell upon was this, that the softness of the plate was not the cause of failure; but in producing the original there was frequently a considerable amount of under-cutting, where the line was wider at the bottom than at the top, so that when the matrix was removed from the plate, there was a certain amount of tearing off from the surface, and he believed it was that circumstance chiefly which had led to the idea that the electrotype process was a failure. They would see that, inasmuch as Mr. Joubert's process started with the use of electrotype plates, it was necessary that the inconvenience in that process which he had pointed out should be understood, in order that it might be guarded against. He feared, looking to the process exhibited that evening, that if the plates were suffered to remain too long in the bath there was danger of the finer lines of the plate becoming partially filled up. He thought a good test would be to take an impression from a plate just out of the hands of the engraver, and before being coated by this process, and also an impression from it after having been coated with iron. He begged the meeting to understand that he had not made these observations in a spirit of opposition to this invention. He was one of those who thought fine works of art could not be too largely distributed, although, in a commercial point of view, he believed this was not considered desirable by some; but it was his desire to see them spread far and wide, and every invention that would tend to cheapen works of art must be welcome to all true lovers of art.

Mr. Joubert remarked that he had been misunderstood if, as stated by the last speaker, he had represented that his process was more particularly intended to be applied to the electrotype plate on account of its softness. It was equally suitable for the original plate, and, as an example, he might state, that the original plate of the engraving behind him (The Playground) had been coated by this process six months ago, and from it he believed 5,000 impressions could now be taken without its being necessary to renew the coating. With regard to the remark that the electrotype plates would yield as many impressions as the original plate, he begged to say that he had with him two impressions of an engraving which went to prove that this was not the case. Refering again to the engraving exhibited, which belonged to the Art-Union of Glasgow, the impression they saw was the artist's proof from the original plate just after the engraving was completed, and here [producing another copy] was an impression taken from the electrotype plate coated by his process. The impression he exhibited was taken when there had been 2,300 printed off, and when examined he did not think that any real difference would be perceived between that impression and the artist's proof. Here [producing another copy of the same engraving] was a bad impression from the electrotype plate not coated, which began to fail after 240 impressions, and completely failed after 400. It was true that electro deposits were better than others, but he believed that, on the average, the number at which the electrotype plates began to fail was from 250 to 300, whilst from the original plate of beaten copper as many as 800 impressions might be taken without "touching."

Mr. Godwin said he had merely stated the fact as it occurred; that in the case of the plate he had referred to, 1,100 copies were taken from the electrotype plate. It was true that frequent "touching" was found necessary.

Mr. Joubert believed his professional brethren present would bear him out, that, if in the instance alluded to, as many impressions were taken from the electrotype plates as from the original plate, it was a very remarkable case. He had known so many "touchings" to be given to a plate that scarcely a particle of the original work remained.

Mr. M'Queen could confirm the statement of Mr. Godwin, with regard to the engraving alluded to, namely, that the electrotypes yielded as many impressions as the original plate.

Mr. Joubert added that Mr. Godwin was quite correct in stating that one of the chief drawbacks of the process of electrotyping was when undercutting occurred in the original plate, but when a plate was engraved with the view of being electrotyped, it was easy for the engraver to avoid undercutting and to secure a good matrix being taken from the plate without tearing off any of the lines.

Mr. Varley expressed a high opinion of the value of this invention.

Mr. Joubert said, that Mr. Godwin seemed to fear that there was danger of the fine lines of an engraving being filled up by the process of metallic coating. By way of experiment, he had tried to deposit a very thick layer of metal upon a plate, without regard to the filling-up of the lines, and he found that it was hardly possible to fill them up.

The Rev. Walter Mitchell begged to inquire how far this invention had been tried commercially, and with what results?

Mr. Joubert admitted the importance of the question just put to him, to which he thought he could not give a better answer than was afforded by a letter which he received two days ago from Mr. Henry Bohn, the well-known publisher, of York-street. Mr. Joubert then quoted from the letter, which stated that no one was more alive than the writer to the value of this discovery. Although he had urged on experimentalists to find out some means of hardening copper-plates, he had never anticipated such success as had been achieved by this process. He had had several of his old copper-plates coated, and was gratified to find that the operation had been entirely successful, reproducing the engraving without any loss of the original delicacy, and yielding a large number of impressions. He (Mr. Bohn) was now testing it upon plates which, but for this process, would be worthless.

Mr. J. Jenkins inquired whether this process had been as yet applied to the engraved plates for porcelain.

Mr. Joubert replied that at the present moment it was being applied with success by one of the largest firms in Staffordshire. He had coated one plate about six weeks ago, and he had received an intimation that the experiment had been so far successful that another plate would be sent to undergo the same process previous to its being printed from.

Mr, Jenkins added that his reason for asking the question was because some years ago it was considered desirable by the pottery manufacturers to supersede the necessity of having a large number of copper plates engraved with the same design. At that time he suggested the use of steel plates instead of copper, but it was found that they were obliged to cut the lines so deep, in order to hold the large amount of colouring matter necessary, that there was great difficulty in using this hard metal. A further objection to the use of steel plates in that class of manufacture was that the smoothness of the surface prevented them from holding the oily description of colouring matter used. In the ordinary mode of printing, the cleaning of the surface of the plate was performed by the hand, but in pottery work the plate was scraped with a spatula, and by that process the oily ink was apt to be dragged out of the lines. He thought the objection he had alluded to might be obviated by merely coating the surface of the plate with steel, not penetrating to the incised parts of the plate. The incisions would then remain copper, which would retain the coloured printing material, whilst the portion exposed to the friction of cleaning would be coated with steel.

Mr. Joubert said the objection to coating the surface of the plate would be that the spatula would just catch the engraved lines, which, not being protected, would become worn. This was one of the objects of coating not only the surface of the plate, but the incised parts also. The same remark applied to ordinary copper-plate printing as well as to the class of work alluded to by Mr. Jenkins.

Mr. Blackwood inquired whether the process had been applied to ordinary printing types and stereotype plates?

Mr. Joubert replied that several plans had been tried for coating types with other metals—such as copper; but as it was known that ordinary printing type would endure a very large amount of wear, it was thought that there was no absolute necessity for applying this process. Stereotype plates also yielded a large number of impressions, and if they became worn out another set of plates could be made at a small expense. The process, however, was capable of application to type-metal, as to any other description of metal.

Mr. Le Keux was aware that for pottery work there was some difficulty in using steel plates. In a mercantile point of view, therefore, he had no doubt that this process could be brought into extensive use, not only in the potteries, but also in Manchester, where copper printing cylinders were so much used; but he thought in the higher branches of engraving, except in the illustration of historical works, although artists would lose nothing by this invention, they would be slow to adopt it until it had been put to some more severe test than he had heard of. The experiments, as far as they had at present been carried, appeared to have been made with old plates, which had, as it were, been resurfaced. With reference to the remarks of Mr. Godwin, relative to the failure of electrotype plates owing to the undercutting, he begged to say that this was a mistake. Many engravers present would bear him out that the beauty of a finished plate, the tone, the air, and the finish was got by the burnisher, and the under-cutting alluded to was not produced by the graver, but by the action of the burnisher.

Mr. Godwin said he simply stated that the undercutting existed, which had the effect upon the electrotype plates that he had mentioned.

Mr. Le Keux continued:—This process was an addition to the surface as well as to the lines of the plate, and he repeated that he was anxious to see it put to a severe test. For mercantile purposes probably 99 persons out of 100 would not know the difference between an impression from the original plate and one from the coated plate; but he wished to see the experiment tried with a plate of high character, and that the results should be submitted to really competent judges. If this test then showed that the process neither robbed the whites nor the blacks, nor filled up the interstices, it might be considered satisfactory. He had not heard that the experiment had been tried to any extent with high class plates. It might be that persons hesitated to expose plates of such high value to the risk of coating, but he could easily understand that those who had a stock of old plates on hand, from which scarcely a hundred impressions could be taken, would be very glad to subject them to a process which would enable them to print off thousands.

Mr. Joubert said he was most anxious to have the opportunity of testing his process upon a plate fresh from the hands of the engraver. As yet he had not tried the experiment upon fresh plates, except upon some of his own, which had been engraved about 12 years ago, and from which only a few impressions had been taken. In the case of these experiments, he, in the first instance, took an impression from the original plates, after which he submitted them to the process of coating, and took another impression. These two impressions were afterwards shown to his friend the chairman, who would, no doubt, kindly state what had occurred with reference to them.

The Chairman said, this being a very important question as far as Mr. Joubert was concerned, he might be permitted to say that the proof which he had selected as being the impression from the original plate, and which he judged to be the best, turned out to have been taken from the coated plate, so that if there was any difference at all the palm of excellence was, in that instance, on the side of the latter.

Mr. William Humphreys remarked, that a previous speaker had referred to the facility with which colouring matter was removed from the plates used in printing for pottery purposes. In ordinary copper-plate printing, a very viscid quality of ink was used, and he recollected the difficulties experienced in the early stages of steel-plate printing on that account, but by the adoption of a suitable ink, the one description of plate was now worked as easily as the other. The great advantage of Mr. Joubert's process he conceived to be this—that, the plate having a steel surface, the ink could be wiped from it previous to printing, with a less amount of friction than was the case with copper-plate, which held the ink more tenaciously, whilst undoubtedly a greater number of impressions could be obtained from a plate treated by this process.

Mr. Winkworth would be glad to have the further confirmation of so high an authority as that of the chairman upon the point mentioned by Mr. Joubert, viz., that the impression taken from the coated plate was, in all respects, equal to that taken from the original plate.

The Chairman said he could easily satisfy Mr. Winkworth upon that point. He understood the capabilities of Mr. Joubert's invention to be this—that an impression might be taken from a copper-plate in whatever condition it might be, whether direct from the hands of the engraver, or after a number of impressions had been taken; it might then be coated with the steel and another impression might be taken, and he understood Mr. Joubert to state that the impression would be identically the same in appearance. As to this being the fact, he could only repeat what he had already stated, viz., that in two specimens that were submitted to him, he selected as the better impression of the two that which had been taken from the steel-coated plate. It undoubtedly was the better of the two, although this might have arisen from some accidental circumstance.

Mr. Yates suggested that a satisfactory test could be afforded by printing with a portion of the plate uncoated. It would then be seen on which side the advantage lay.

Mr. Joubert said that experiment was about to be tried in the course of a few days by Mr. Virtue.

Mr. Winkworth had been requested to ask one other question, viz., whether the recently-published engraving of the execution of Lady Jane Grey, after Paul Delaroche, had been worked from a plate which had been subjected to Mr. Joubert's process, and whether the greater number of impressions had not been printed from the coated plate.

Mr. Joubert replied that the engraving alluded to had been a considerable number of years in hand. It was the work of an Italian artist, who began it 25 years ago, and though not constantly engaged upon it, worked at it for many years. The result was, that when the plate was finished, owing to the long time occupied upon it, either from the friction of the sleeve or the hand of the artist, the plate was very much worn, and a well-known printer in Paris, to whom the execution of the work was entrusted by the publisher who had purchased the plate, made the startling announcement that he could not produce more than 75 or 80 impressions from it. That was a most serious matter with regard to an engraving that had cost between £3,000 and £4,000, as the publisher could put no price upon the impressions to repay him for his outlay. The consequence was that the plate was electrotyped. Four plates were successfully taken, and from those the publisher intended to print the limited number of 300 copies, upon which a price would be put to repay him for the cost of the engraving. Having, however, heard of this process, he called upon M. Garnier, the inventor, and asked him to undertake an experiment with his plate. At that time the process had not been tried upon any plate of consequence, and M. Garnier felt a little nervous about it. He was however prevailed upon to try it upon the four electro-types. Impressions were taken before and after the coating, which were submitted to the principal engravers in Paris, who pronounced the experiment entirely successful—they, in fact, said they could detect no difference between the two.

The Chairman said it was now his agreeable duty to propose a vote of thanks to Mr. Joubert for the Paper he had read, and he thought the frank, truthful, and, he might add, understating spirit which had characterised all that he had said, entitled him to their respect, as well as to their thanks. With regard to this, he must call it, important process, he thought it might be considered one of the great discoveries of the age. Very analogous to this was the discovery made a few years ago, also in Paris, of a material for indurating stone, which had since been extensively carried out, and he believed that architects might now defy the efforts of the elements and of time upon their structures. With regard to Mr. Joubert's process, the point which had principally occupied their attention, was its capability of producing impressions from the coated plates equal to those from the uncoated plates, and on this he (the Chairman) had given his opinion. The other important point was, the durability which it imparted to the plates, and the quality it gave of multiplying copies to a considerable extent. But the pretensions of the discovery were yet greater; in fact he saw no limit whatever to the working of plates when subject to this process. As soon as one coating exhibited symptoms of wear, it could be removed and another coating put on; and, inasmuch as the printer could detect the slightest tendency to failure, the work could be stopped at any time, and thus the plate would be kept in a condition to produce impressions equal to proofs throughout the entire publication. If he was correct in what he had stated—and, so far as his knowledge enabled him to judge, he was so, he was sure he need only to invite them to accord their thanks to Mr. Joubert for having brought before them so important and so valuable an addition to the scientific discoveries of the present age.

A vote of thanks was passed to Mr. Joubert.

The Secretary announced that, on Wednesday evening next, the 1st of December, a Paper, by Mr. Hyde Clarke, "On Copper Smelting," would be read.

GUTTA PERCHA.

The following communication has been received from Don Jose D'Almeida, and has been laid before the Council:—

To the Secretary of the Society of Arts.

Sir,—I have noticed in the catalogue of the Exhibition of 1851, that the late Dr. W. Montgomerie was named as the first who introduced gutta percha into Europe. As gutta percha is now playing so important a part in the advancement of science and cultivation, it is proper that the public should be acqainted with its true history, and that honour should be rendered to whom honour is due.

I therefore think it my duty to draw public attention to the fact that my late father (Dr. Jose d'Almeida) was the first to introduce gutta percha to the notice of scientific men in England,—by presenting specimens to the Royal Asiatic Society of London, as an article possessing novel and peculiar properties, previous to the time when Dr. Montgomerie brought his specimens to Europe.

When my father first saw this article in the hands of the natives he was so impressed with an opinion that it had properties of great value to science, that he submitted specimens to some commercial and scientific friends, long before he presented those to the Royal

Asiatic Society of London; in proof of those statements I beg to refer you to the Royal Asiatic Society's Transactions (copy of the Secretary's note enclosed), and to the notices by Mr. Oxley, in the Journal of Indian Archipelago, vol. 1, pp. 22 and 78 (extracts of which herewith).

I beg, therefore, to request that proper notice of this fact should be made public through your Society, and remain, Sir, yours, &c. J. D'ALMEIDA.

Extract from the Journal of the Indian Archipelago, vol. i. page 22; notices by Mr. J. Oxley, A.B., senior surgeon of the Straits settlement of Prince of Wales's Island, Singapore, and Malacca:—

"Although the trees yielding this substance abound in our indigenous forests, it is only four years since it was discovered by Europeans.

"The first notice of it appears to have been by Dr. Wm. Montgomerie, in a letter to the Bengal Medical Board in the beginning of 1843, wherein he commends the substance as likely to prove useful for some surgical purposes, and supposes it to belong to the fig tribe. In April, 1843, the substance was taken to Europe by Dr. D'Almeida, who presented it to the Royal Asiatic Society of Arts* of London, but it did not at first attract much attention, as the Society simply acknowledged the receipt of the gift, whereas, shortly after, they thought proper to award a gold medal to Dr. Montgomerie for a similar service.

"Now as the discovery of both these gentlemen rested pretty much upon the same foundation,—the accidental falling in with it in the hands of some Malays, who had found out its greatest peculiarity, and, availing themselves thereof, manufactured it into whips, which were brought into town for sale,—there does not appear any plausible reason for passing over the first and rewarding the second.

"Both gentlemen are highly to be commended for endeavouring to introduce to public notice a substance which has proved so useful and interesting."

[Extract from page 78.]

"Dr. D'Almeida left Singapore for Calcutta in the latter end of November, 1842, arrived at Calcutta in the end of December of the same year; left Calcutta in the middle of July, 1843, by the steamer *Hindoostan*, and arrived at Southampton about the end of March.

"A few days before leaving Singapore, he bought from the natives some whips made of the Gutta Percha; some of the prepared substance, and some of it in its primitive state—this specimen being presented for the first time for sale at Singapore.

"During Dr. D'Almeida's passage to England, he gave a piece of this specimen to Mr. Charles Carnie, then a passenger in the same steamer, who, although a resident of Singapore, was unacquainted with this product.

"In London Dr. D'Almeida gave a portion of the specimens to Mr. W. C. Crane to be analysed, and about the end of April, 1843, presented the remainder to the Royal Asiatic Society. A letter of acknowledgment from the Secretary was transmitted to Dr. D'Almeida, which he received at Southampton, in the beginning of May of the above year, on his return from Paris. The same substance was shown in London to Mr. A. A. Luckerstein before it was delivered to the Royal Asiatic Society."

(True Copies) J. D'ALMEIDA.

(Copy)

Royal Asiatic Society, 5, New Burlington Street,
London, 3rd September, 1858

Extract from the list of "Donations to the Royal Asiatic Society, from April, 1842, *to June,* 1844" (Vide Journal of the Society, vol. viii. page 15):—

"A riding whip made of the concrete milk of a tree indigenous in Singapore, called Gutta Percha by the Malays; also the concrete milk in the lump: it is made ductile by being placed in hot water: presented by Don Jose D'Almeida."

The specimen of the concrete milk above-named is still preserved in the Museum of the Royal Asiatic Society, and a label pasted upon it states that it was deposited in April, 1843.

(Signed) WILLIAM NEAL,
(For Secretary).

P.S.—A piece of the above-mentioned specimen of Gutta Percha was given to Dr. J. F. Royle, but I am not aware that he made any experiments upon it.

(Signed) W. N.

ON THE HARDNESS OF METALS AND ALLOYS.

By F. Crace Calvert, M.R.A. of Turin, F.C.S., &c.; and Richard Johnson, F.C.S., &c.

[Read before the Literary and Philosophical Society of Manchester.]

The process at present adopted for determining the comparative degree of hardness of bodies, consists in rubbing one body against another, and that which indents or scratches the other is admitted to be the harder of the two bodies experimented upon. Thus, for example:—

Diamond,
Topaz,
Quartz,
Steel,
Iron,
Copper,
Tin,
Lead,

This method is not only very unsatisfactory in its results, but it is also inapplicable for determining with precision the various degrees of hardness of the different metals and their alloys. We therefore thought that it would be useful and interesting if we were to adopt a process which would enable us to represent by numbers the comparative degrees of hardness of various metals and their alloys.

To carry out these views we devised the following apparatus and method of operating. The machine used is on the principle of a lever, with this important modification, that the piece of metal experimented upon can be relieved from the pressure of the weight employed without removing the weight from the end of the longer arm of the lever. The machine consists of a lever, with a counterpoise and a plate, on which the weights are gradually placed; the fulcrum bears on a square bar of iron, passing through supports. The bar is graduated, and has at its end a conical steel point, 7*mm.* or 0·275 of an inch long, 5*mm.* or 0·197 of an inch wide at the base, and 1·25*mm.* or 0·049 of an inch wide at the point which bears on the piece of metal to be experimented on, and this is supported on a solid piece of iron. The support, or point of resistance is lowered or raised by a screw, and when, therefore, this screw is turned, the whole of the weight on the lever is borne by the support and the screw. When it is necessary, by turning the screw the weight on the lever is re-established on the bar, and experimented upon.

When we wished to determine the degree of hardness of a substance, we placed it on the plate, and rested the point upon it, noticing the exact mark on the bar, and then gradually added weights on the end of the lever until the steel point entered 3·5*mm.* or 0·128 of an inch during half an hour, and then read off the weight. A result was never accepted without at least two experiments being made, which corresponded so far as to present a difference of only a few pounds. The following table gives the relative degree of hardness of some of the more common metals. We specially confine our researches to this class, wishing the results to be practically useful to engineers and others who have to employ metals, and often require to know the comparative hardness of metals and alloys.

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* Mr. Oxley evidently confounds the Royal Asiatic Society with the Society of Arts. It was the latter Society which awarded the Gold Medal to Dr. Montgomerie.—Ed. *S. of A. Journal.*

Names of Metals.	Weight Employed.	Calculated Cast Iron = 1000.
Staffordshire Cold Blast Cast Iron—Grey, No. 3..........	4800 lbs.	1000
Steel..................................	4600 ?	958 ?
Wrought Iron*	4550	948
Platinum..........................	1800	375
Copper—pure	1445	301
Aluminium........................	1300	271
Silver—pure......................	1000	208
Zinc ,, ...	880	183
Gold ,, ...	800	167
Cadmium ,, ...	520	108
Bismuth ,, ...	250	52
Tin ,, ...	130	27
Lead ,, ...	75	16

* This wrought iron was made from the above-mentioned cast iron.

This table exhibits a curious fact, viz., the high degree of hardness of cast iron as compared with that of all other metals, and although we found alloys which possessed an extraordinary degree of hardness, still none were equal to cast iron.

The first series of alloys we shall give is that of copper and zinc.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated* Cast Iron = 1000.
	lbs.		
$ZnCu_5$ { Cu 82·95 Zn 17·05 } ...	2050	427·08	280·83
$ZnCu_4$ { Cu 79·56 Zn 20·44 } ...	2250	468·75	276·82
$ZnCu_3$ { Cu 74·48 Zn 25·52 } ...	2250	468·75	276·04
$ZnCu_2$ { Cu 66·06 Zn 33·94 } ...	2270	472·92	261·04
$ZnCu$ { Cu 49·32 Zn 50·68 } ...	2900	604·17	243·33
$CuZn_2$ { Cu 32·74 Zn 67·26 } ...	Broke with 1500 lbs. without the point entering.		
$CuZn_3$ { Cu 24·64 Zn 75·36 } ...	Broke with 1500 lbs. with an impression ½ *mm.* deep.		
$CuZn_4$ { Cu 19·57 Zn 80·43 } ...	Entered a little more than the above; broke with 2000 lbs.		
$CuZn_5$ { Cu 16·30 Zn 83·70 } ...	Entered 2 *mm.* with 1500 lbs.; broke with 1700 lbs.		

* To calculate the hardness of an alloy we multiplied the per centage quantity of each metal by the respective hardness of that metal, added the two results together, and divided by 100. The quotient is the theoretical hardness.

These results show that all the alloys containing an excess of copper are much harder than the metals composing them, and, what is not less interesting, that the increased degree of hardness is due to the zinc, the softer metal of the two which compose these alloys. The quantity of this metal must, however, not exceed 50 per cent. of the alloy, or the alloy becomes so brittle that it breaks as the steel point penetrates. We believe that some of these alloys, with an excess of zinc, and which are not found in commerce owing to their white appearance, deserve the attention of engineers. There is in this series an alloy to which we wish to draw special attention, viz., the alloy Cu Zn, composed in 100 parts of

Copper .... 49·32
Zinc .... 50·68
100·00

Although this alloy contains about 20 per cent. more zinc than any of the brasses of commerce, still it is, when carefully prepared, far richer in colour than the ordinary alloys of commerce. The only reason that we can give why it has not been introduced into the market is, that when the amount of zinc employed exceeds 33 per cent., the brass produced becomes so white that the manufacturers have deemed it advisable not to exceed that proportion. If, however, they had increased the quantity to exactly 50·68 per cent., and mixed the metals well, they would have obtained an alloy as rich in colour as if it had contained 90 per cent. of copper, and of a hardness three times as great as that given by calculation. In order to enable engineers to form an opinion as to the value of this cheap alloy, we give them the degrees of hardness of several commercial brasses:—

Commercial Brasses.	Weight employed.	Cast Iron = 1000.	
		Obtained.	Calculated
	lbs.		
"Large Bearing" { Copper 82·05 *Tin... 12·82 Zinc ... 5·13	2700	562	259
"Mud Plugs" ... { Copper 80 *Tin... 10 Zinc ... 10	3600	750	262
"Yellow Brass".. { Copper 64 Zinc ... 36	2500	520	258
"Pumps & Pipes" { Copper 80·0 *Tin... 5·0 Zinc ... 7 5 Lead... 7·5	1650	343	257

* These alloys all contain tin.

The alloy Cu Zn possesses another remarkable property, viz., the facility with which it is capable of crystallising in prisms half an inch in length, of extreme flexibility. There is no doubt that this alloy is a definite chemical compound, and not a mixture of metals, as alloys are generally considered to be. Our researches on the conductibility of heat by alloys, recently presented to the Royal Society, leave no doubt that many alloys are definite chemical compounds.

ON BRONZE ALLOYS.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
	lbs.		
$CuSn_5$ { Cu 9·73 Sn 90·27 }	400	88·33	51·67
$CuSn_4$ { Cu 11·86 Sn 88·14 }	460	95·81	59·56
$CuSn_3$ { Cu 15·21 Sn 84·79 }	500	104·17	68·75
$CuSn_2$ { Cu 21·21 Sn 78·79 }	650	135·42	84·79
$CuSn$ { Cu 34·98 Sn 65·02 }	At 700 lbs. the point entered one half and the alloy broke.		
$SnCu_2$ { Cu 48·17 Sn 51·83 }	At 800 lbs. the alloy broke without the point entering.		
$SnCu_3$ { Cu 61·79 Sn 38·21 }	At 800 lbs. the alloy broke in small pieces (blue alloy).		
$SnCu_4$ { Cu 68·27 Sn 31·73 }	1300 lbs. divided the alloy in two, point not entering 1 *mm.*		
$SnCu_5$ { Cu 72·90 Sn 27·10 }	The same as the preceding.		
$SnCu_{10}$ { Cu 84·32 Sn 15·68 }	4400	916·66	257·08
$SnCu_{15}$ { Cu 88·97 Sn 11·03 }	3710	772·92	270·83
$SnCu_{20}$ { Cu 91·49 Sn 8·51 }	3070	639·58	277·70
$SnCu_{25}$ { Cu 93·17 Sn 6·83 }	2890	602·08	279·16

The results obtained from this series of alloys lead to several conclusions deserving our notice. First, the marked softness of all the alloys containing an excess of tin; secondly, the extraordinary fact that an increased quantity of so malleable a metal as copper should so suddenly render the alloy brittle, for the

Alloy $Cu\ Sn_2$
or
Copper ...... 21·21 }
Tin .... 78·79 } is not brittle,

whilst the alloy $Cu\ Sn$
or
Copper ...... 34·98 }
Tin .... 65.02 } is brittle.

Therefore the addition of 14 per cent. of copper renders a bronze alloy brittle. This curious fact is observed in all the alloys with excess of copper, $Sn\ Cu_2$, $Sn\ Cu_3$, $Sn\ Cu_4$, $Sn\ Cu^5$, until we arrive at one containing a great excess of copper, viz., the alloy $Sn\ Cu_{10}$, consisting of copper 84·68 and tin 15·32, when the brittleness ceases; but, strange to say, this alloy, which contains four-fifths of its weight of copper, is, notwithstanding, nearly as hard as iron. This remarkable influence of copper in the bronze alloys is also visible in those composed of

$Sn\ Cu_{15}$, containing 88·97 of copper.
$Sn\ Cu_{20}$, ,, 91·49 ,,
$Sn\ Cu_{25}$, ,, 93·17 ,,

Copper acquires such an increased degree of hardness by being alloyed with tin or zinc, that we thought it interesting to ascertain if alloys composed of these two metals would also have a greater degree of hardness than that indicated by theory; we accordingly had a series of alloys prepared in equivalent quantities, and these are the results arrived at:—

Formulæ of Alloys and per centages of each.	Weight Employed.	Obtained Cast Iron = 1000.	Calculated Cast Iron = 1000.
	lbs.		
$Zn\ Sn_2$ { Zn 21·65 Sn 78·35 }	300	64·50	60·83
$Zn\ Sn$ { Zn 35·60 Sn 64·40 }	330	68·75	82·70
$Sn\ Zn_2$ { Sn 47·49 Zn 52·51 }	400	83 33	110·00
$Sn\ Zn_3$ { Sn 37·57 Zn 62·43 }	450	93·70	124·58
$Sn\ Zn_4$ { Sn 31·14 Zn 68·86 }	505	105·20	131·22
$Sn\ Zn_5$ { Sn 26·57 Zn 73·43 }	600	125·00	142·08
$Sn\ Zn_{10}$ { Sn 15·32 Zn 84·68 }	580	120·83	158·33

These results show that these metals exert no action on each other, as the numbers indicating the degrees of hardness of their alloys are rather less than those required by theory. Our researches on the conductibility of heat by the three above series of alloys throw, we believe, some light on the great difference which the alloys of bronze present as compared with those of tin and zinc; for we have stated above that the latter conduct heat as a mixture of metals would do, and not as the former series, which conduct heat as definite chemical compounds.

We shall conclude by giving the degrees of hardness of two other series of alloys, viz., those composed of lead and antimony, and lead and tin. In the series of lead and tin we find that tin also increases the hardness of lead, but not in the same degree as it does that of copper.

LEAD AND ANTIMONY.

Formulæ of Alloys and per centages.	Weight Employed.	
	lbs.	
$Pb\ Sb_5$ { Pb 24·31 Sb 75·69 } ..	....	Entered 2·5*mm.* with 800 lbs.; then broke.
$Pb\ Sb_4$ { Pb 28·64 Sb 71·36 } ..	....	Entered 2·7*mm.* with 800 lbs.; broke with 900 lbs.
$Pb\ Sb_3$ { Pb 34·86 Sb 65·14 } ..	875	
$Pb\ Sb_2$ { Pb 44·53 Sb 55·47 } ..	....	Entered 2·5*mm.* with 500 lbs.; broke with 600 lbs.
$Pb\ Sb$ { Pb 61·61 Sb 38·39 } ..	500	
$Sb\ Pb_2$ { Pb 76·32 Sb 23·68 } ..	385	
$Sb\ Pb_3$ { Pb 82·80 Sb 17·20 } ..	310	
$Sb\ Pb_4$ { Pb 86·52 Sb 13·48 } ..	300	
$Sb\ Pb_5$ { Pb 88·92 Sb 11·08 } ..	295	

LEAD AND TIN.

Formulæ of Alloys and per centages.	Weight Employed.	Obtained Cast Iron =1000.	Calculated Cast Iron =1000.
	lbs.		
$Pb\ Sn_5$ { Pb 26·03 Sn 73·97 }	200	41·67	23·96
$Pb\ Sn_4$ { Pb 30·57 Sn 69·43 }	105	40·62	23·58
$Pb\ Sn_3$ { Pb 36·99 Sn 63·01 }	160	32·33	22·83
$Pb\ Sn_2$ { Pb 46·82 Sn 53·18 }	125	26·04	20·09
$Pb\ Sn$ { Pb 63·78 Sn 36·22 }	100	20·83	19·77
$Sn\ Pb_2$ { Pb 77·89 Sn 22·11 }	125	26·04	18·12
$Sn\ Pb_3$ { Pb 84·09 Sn 15·91 }	135	28·12	17·23
$Sn\ Pb_4$ { Pb 87·57 Sn 12·43 }	125	26·04	17·08
$Sn\ Pb_5$ { Pb 89·80 Sn 10·20 }	110	22·92	16·77

We have great pleasure in thanking here Mr. Siméon Stoikowitsch, F.C.S., for his valuable assistance during these long researches.

STEPHENSON MEMORIAL SCHOOLS.

The laying of the foundation stone of the memorial schools to George Stephenson, about to be built at Willington, near Newcastle-on-Tyne, took place on Tuesday, the 16th November.

The site contains a quarter of an acre, with a good frontage of 100 feet towards the river, and was a present from the Corporation of Newcastle. The buildings consist of school-rooms for boys, girls, and infants, with a house for a master and mistress attached, and a large library and reading room for the use of the neighbourhood. The total cost will exceed £2,000. The plans have been approved by the Government, who assist the scheme by a grant.

There were present at the ceremony Joseph Laycock, Esq., Mayor of Newcastle; E. Potter, Esq., of Cramlington Hall, Mayor of Tynemouth; Thomas Sopwith, Esq., of Allenheads; Mrs. and Miss Sopwith; Mr. and Mrs. Addison Potter, &c., &c.

The stone was laid by Mrs. Addison Potter, the inscription upon it stating that

"The building occupies the site of the dwelling-house formerly the residence of George Stephenson, in which his son Robert Stephenson was born on the 16th of November, 1803."

After the stone had been laid and a prayer offered up, Mr. Addison Potter said that an intimate friend, not only of Mr. Robert Stephenson, but also of the late George Stephenson, was present, Mr. Sopwith, whom he would call upon to address the meeting.

Mr. **Sopwith** responded to the call, and in the course of his speech observed that among the incidents of George Stephenson's life, that which most chiefly concerned the occasion of the present meeting was, that of his having in the year 1802 come to reside upon the very spot where he (Mr. Sopwith) was now standing—and in the following year, 1803, upon that very day, November 16th, his son Robert Stephenson was there born. He thought this was a circumstance of which the inhabitants of the locality might be justly proud, for it was a spot which in future ages would be looked upon with interest, as connected with the history of these two great men. He dwelt at some length upon the early struggles of George Stephenson, his anxiety for knowledge, and the sacrifices he made in order to give a good education to his now distinguished son. After speaking of the interest which Mr. Robert Stephenson himself took in the progress of education, Mr. Sopwith concluded by expressing a hope that everything would be done in those schools with a view to promote the glory of God, as well as the good estate and condition of the children who were educated there.

A vote of thanks was then passed to Mrs. Addison Potter, on the motion of the Mayor of Newcastle, which having been duly acknowledged by Mr. Addison Potter, the meeting separated.

Colonial Correspondence.

EMIGRATION TO BRITISH HONDURAS.

Belize District, 17th October, 1858.

Sir,—I forward to you a letter which I have received from two coloured persons residing at Detroit, Michigan, United States. Their wish is to emigrate to some country where their complexion will not operate against their rising in the world, and where they will not be subject to the taunts and indignities which all belonging to their race must suffer in America. I also send you my reply to their letter.

Detroit, Mich., August 5, 1858.

Gentlemen,—We have been by friends advised to emigrate to Central America, and on the account of it we wrote lately to W. Stevenson, Esq., for such information as would lead us to a suitable part of the country. If you are in any way acquainted with the institutions that exist in the United States, you know that near 4,000,000 slaves * * * this country, whose soil is stained with their blood, and you also know that we, of the pretended free north, are their descendants, part of their blood, and are bound in one common cause to each other, that is politically and socially, but the experience of years of painful anxiety has satisfied us that, side by side with our brethren, we can do them but little good, and nothing for ourselves or our race. We have been advised to try to find a home in some other country, as we hold a position in this that no intelligent people can longer endure. We are not only, gentlemen, suffering socially and politically, but every avenue of wealth is most effectually closed against the coloured men of the country, thus making us constantly dependent, and not in any way self-sustaining. This poverty arises from the proscription we suffer, which keeps us out of all lucrative employment. Indolence is not a characteristic of the negroes of America, since if they had equal chance here with the white man, they would make the same proficiency in acquiring wealth. But to leave that dark and unpleasant picture, let us for a moment look at the future of the American negro. This question, more that any other question, now occupies our minds,—what is our duty as parents and brethren of the same race and complexion? What course shall we enter upon is now the question of the most vitality. We have been the most favourably impressed with the Central American states, and as such is our mind, we are in want of main facts by the which we can make our selection of a home. We do not believe, gentlemen, that we appeal to those who will not give us their early attention in so important a matter as the selection of a home. We are not soliciting for sympathy or benevolence, but that we may have a place where we may by our strong arm work ourselves up to that position to demand respect from all who may chance to make our acquaintance. You, or either of you, will then confer on us a favour by writing and letting us know what in your power you can that will be of interest to our emigration to Central America, and what season of the year would you advise us to come in, and to what state or county. You know what information a stranger wants, all of which we ask you. We did write to Mr. Stephenson some weeks ago, and now we write to you, and hope to hear from both soon. We want farming land, navigable streams, water power, and so forth. Please give this your early attention, and much oblige

Yours truly,
(Signed) J. M. WILLIAMS.
WM. E. MONRO.

[Reply.]

Belize, B. Honduras, October 17th, 1858.

Sirs,—Your letter, addressed to myself and others, and dated "Detroit, Michigan, August 5th," I have just received.

You state that in the United States there is no avenue by which you and your brethren can arrive at a position of independence; that you have been advised to emigrate to Central America, and that you wish me to give you information respecting that country, and what period of the year would be the best in which to proceed to it. I have much pleasure in furnishing you with the information which you require. That portion of the Isthmus which is denominated Central America consists of five independent states, viz., Guatemala, Costa Rica, San Salvador, Nicaragua, and Honduras. Each possesses a republican form of government, an elected president being at the head of it for a limited period. The country is very mountainous, extremely fertile, and in some parts most salubrious. The inhabitants are a mixture of the old Spaniard and the aboriginal Indian. They are indolent, treacherous, sanguinary, and cruel. With every advantage which nature could bestow upon it, the country has not progressed; on the contrary, it has retrograded from the position which it held whilst it was under the dominion of Spain. Since their revolt from the mother country, the different states have almost constantly been at war with each other, whilst the vitals of each have been devoured by internal struggles for political power, during which human blood has flowed like water. In every one of the states life and property are alike unprotected. In addition to these scourges of the country, some of the states have recently been invaded by American filibusters, who, in their ruthless course, have respected no laws human or divine, have burnt towns to ashes, have desecrated churches, and put to death men, women, and children.

It is not surprising that during such a state of things agriculture and commerce should have been almost entirely neglected. I could not counsel you to settle in such a country. Nay, as you have asked me for advice and information, I should not be acting rightly if I did not attempt to dissuade you from the step. Far better would it be to remain in the land which gave you birth, although that land is, as you say, "Stained with the blood of the slave." There, although you may be subjected to many indignities, although you may not be able to raise yourselves in the social scale, still you cannot be deprived of your lives and property so long as you do not transgress the law.

But if you are sincerely desirous of emigrating to a country where, by honest industry, you may be able to better your condition, where there is no distinction of races, where the white and the black man are equally protected by the law, let me earnestly invite you to British Honduras. Here, under the benign sway of Queen Victoria, and governed by British laws, you may pursue your various callings, and arrive at a position which shall command the respectful consideration of your fellow-citizens.

You say that you require farming land, navigable streams, and water power. All these exist in the greatest abundance in British Honduras. The land, which is a perfectly virgin soil, is capable of producing everything which grows in a tropical country. The sugar cane, cotton, coffee, rice, cacao, &c., grow

here in perfection. One planting of the cane will last three years, and the cotton of this country has been pronounced to be as good as that of the Southern States of America. If you and your brethren—as many as you like—hundreds, thousands—will come here with stout hearts and determined minds, the government will lease you crown land for the purpose of cultivation at a rent of one dollar a year for every two acres. I must, however, tell you that this land you will have to clear, and labour here is very scarce. To use your own expression, you must "by your own strong arm work yourselves up to a position to command the respect of all who make your acquaintance." You may come at any season of the year.

I am, &c.,
R. TEMPLE,
Chief Justice of British Honduras.

I sincerely hope that Mr. Williams, Mr. Monro, and friends and brethren may be induced to emigrate to this country. Two shillings a year for every acre of rich virgin land is surely a low rent enough, and if the men are really in earnest, they will not fail to avail themselves of so advantageous an offer. But this offer is not merely made to them, it is made to the industrious poor in every part of the world. It is made to the poor Irishman, whose squalid wretchedness, whose famished children, whose sick wife drive to the commission of crime. It is made to these miserable mechanics who, —when the ground is hardened by the frost—when the bricklayer and the mason are obliged to throw down the plummet and the trowel—when the gardener is compelled to cast aside his spade, besiege the metropolitan police officers, demanding bread. It is made to those denizens of the London alleys whose trade is pocket-picking. It made to the dwellers in Edinburgh wynds and closes, to whom the pure untainted breath of heaven seldom comes. If indolence and vice have not become settled habits with them; if all taste for honesty be not completely gone; if the bread of honourable toil has yet some remains of sweetness to their palate—let them come here, and they shall be rescued from the tempter who, in different ways, and by various baits, is leading them on by imperceptible degrees to their destruction. Two acres of rich land. which the spade has never yet penetrated, for four shillings a year, they shall have. Two acres of land on which they may grow sugar, cotton, coffee, maize, rice, tobacco, arrow-root, cassava, peppers, oranges, figs, pineapples, melons, cocoa-nuts—on which they may breed stock of every kind. Anglo-Saxons and Celts, with sandy locks or raven hair, with blue eyes or black, wherever you are, in Irish hovels, Edinburgh holes, in London styes—I say to you, come. Leave off pocket-picking and poaching; leave off sniggling hares, netting partridges, and administering to the trout and the salmon doses of Cocculus Indicus, forget Mr. Smith's strong box and Mrs. Robinson's silver spoons; leave off wallowing in the filth of metropolitan vice and sensuality; leave off begging and telling your piteous fables, and pinching your "babbies" until they are black and blue; you limping fellow, throw away your crutches and let down your leg; you blind man, open your great, grey, goggle eyes; you with the withered arm, untie that bandage, and come, one and all, to a country where the means will be afforded you of becoming good men and true, and of making a proper use of that reason which God has given to you, and which ought gloriously to distinguish you from the brutes that perish, but which, alas! has either been used to enable you dexterously to infringe God's laws and man's laws, or else has been drowned and extinguished by your own depraved tastes and habits. If there be a spark of your original nature left in you, a spark of that nature which you received at your birth, you will not omit to take advantage of an offer which will enable you to become respectable, and, perhaps, wealthy members of society.

It is a mistake to suppose that the white man cannot work in the tropics. He can work better than the negro, and with as little injury to his constitution. The belief originated in idleness and pride. The first settlers in the New World were Spaniards; they were soldiers—they were robbers—they wished to possess themselves of the treasures of the country which they had discovered; they were ready to fight for them, for these plunderers were brave, but they disdained to acquire them by ignoble toil. "Gold, gold," was their cry, "bring us gold." They would ford rivers; they would climb precipitous rocks; they would penetrate almost impervious forests; they would march through the burning sun of noon; they would repose under the chilling dews of night—for gold—but they would not till the earth. Cutting and slaying was an honourable employment, but turning up the soil was degrading; the sword was the weapon of a gentleman, but the spade was the implement of a serf; they would cut a throat and sing Io Pæan—but to dig they were ashamed. But could they not have worked if they had chosen? Did they not work? Who built those strong, frowning fortresses which are yet standing in various parts of Central America and the West Indies? Who erected those splendid cathedrals which are everywhere to be met with in the New World? It is utter nonsense to say that the negro only can labour in the tropics. The planters of the Southern States of America will tell you so, because it is an excuse (they think) for slavery. The planters of Cuba will tell you so, because it is an excuse for indolence. What has a labourer to contend against in the tropics?—The blazing sun; granted. But he need not work in the blazing sun. If he labour from five o'clock in the morning until ten, and from three o'clock in the afternoon until six, he will entirely escape the blazing sun. Is there any other impediment for him to encounter?—None, except brandy. But what are the evils to which a labourer is exposed in England or Scotland? —Snow, sleet, rain, the cold north and the cutting east wind; and when his work is done a meagre supper, a fireless grate, a hard straw mattress covered with a thin ragged rug on which to repose his cold, weary shivering, bones. And what are the consequences of all this?—Rheumatism, catarrh, sore-throat, pleurisy, consumption, which the tropical labourer never hears of. Tell me not that the European is not able to labour in the tropics.—I am, &c., R. TEMPLE.

Proceedings of Institutions.

WHITBY INSTITUTE.—The thirteenth annual report of the Institute of Popular Arts, Science, and Literature, states that the revenue from subscriptions is in advance of the preceding year, and has attained a point which it has never reached in any former period. The total balance in the treasurer's hands is £56 0s. 2d.; being £22 11s. 10d. more than the sum received from last year's accounts. This is independent of a year's interest due upon £120 remaining in the bank, which has not this year been disturbed. The donation of £10 by Robert Stephenson, Esq., was given for the exclusive benefit of the library, and has been appropriated to that object. A decline of 258 books has taken place in the issues of books as compared with last year, the total number being 3354. In the class department a considerable degree of success has been attained. The general instruction and navigation class was well attended throughout, the average number being 41. The productions in architectural drawing were highly creditable. A German class, under the voluntary tuition of Mr. D. Elias, a German, has been most successful. An essay class was formed at the end of the winter, and produced some well digested and well written papers. It will be one of the tasks of the incoming body of directors, in conjunction with the class committee, to adapt the instruction of the classes, so that students may be able to prepare themselves for the annual examinations of the Society of Arts.

MEETINGS FOR THE ENSUING WEEK.

MON.......Actuaries, 7. I. "On the Improvement of Life Contingency Calculation." II. "The system of Dependent Risks." By Mr. Farren.
London Institution, 7. Prof. Tyndall, "On Light."
British Architects, 8.

TUES. ...Civil Engineers, 8. Discussion, "On Steep Inclines on American Railways." And, if time permits, Mr. M. Scott, M. Inst. C.E., "Description of a Breakwater at the Port of Blyth, &c."

WED. ...London Institution, 3. Mr. Thomas R. Jones, "On the Natural History of the Vertebrate-Division of the Animal Kingdom."
Zoological, 3.
Society of Arts, 8. Mr. Hyde Clarke, "On Copper Smelting."
Geological, 8 Sir R. I. Murchison, F.R.S., "On the Geological Structure of the North of Scotland, and the Orkney and Shetland Isles."

THURS....London Institution, 7. Dr. E. Frankland, "On the Air and Water of Towns."
Chemical, 8. I. Mr. Mercer, "On Atomic Weights" II. Mr Barratt, "On the Analysis of the Water from Holywell, North Wales."
Linnæan, 8. I. Mr. S. Hanley, "On the Linnæan MS. of the Museum Ulricæ." II. Prof. Henfrey, "On the Morphology of the Balsaminaceæ."

FRI. ......Archæological, 4.

SAT. ......London Institution, 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 19, 1858.]

Dated 29th September, 1858.

2162. E. L. Benzon, Sheffield—Imp. in the manufacture of steel. (A com.)

Dated 27th September, 1858.

2172. G. T. Bousfield, Loughborough-park, Brixton—Imp. in apparatus for and in the manufacture of paper bags and other similar articles. (A com.)

Dated 1st October, 1858.

2190. T. Preston, Nottingham—Imp. in the manufacture of looped fabrics.

Dated 8th October, 1858.

2236. E. V. Rippingille, Chorlton-upon-Medlock, Greenheys, Manchester—The imp. of fire-arms and artillery.

Dated 20th October, 1858.

2342. P. C. Stortz, Havelock-buildings, Bold street, Liverpool—Imp. in the materials of photographic plates.

Dated 21st October, 1858.

2350. C. W. Williams, and G. Eyton, Liverpool—Imp. in the construction of locomotive and other steam-boilers.

Dated 27th October, 1858.

2394. L. Wray, 5 Devonshire-street, Portland-place—The preparation and application of a substitute for gutta percha, caoutchouc, and similar substances.

Dated 1st November, 1858.

2430. C. Vero and J. Everitt, Atherstone, Warwickshire—Imp. in the manufacture of hats and other coverings for the head, a part of which imp. is also applicable to the manufacture of felt.
2432. J. Dobson and D. Pearce, St. James -street—Imp. in the manufacture of bird-cages.
2434. E. Maynard, Brooklyn, New York, U.S.—Imp. in submarine telegraph cables.
2436. W. Palmer, New York, U.S.—Imp. in fire-arms.

Dated 2nd November, 1858.

2440. D. Tomasini, Store-street, Bedford-square—Imp. in respirators.
2442. R. C. Smith, Birmingham—A new or improved buoy or wreck intelligencer.
2444. M. L. J. Lavator, Strand—Imp. in cartridges for military and other purposes.
2446. D. D. Kyle, Albany-street, Regent's-park—Imp. in boots and shoes.
2448. A. McDougall, Manchester—Imp. in the construction of reservoirs, tanks, culverts, seawalls, and other erections required to exclude water or damp.

Dated 3rd November, 1858.

2450. S. Bottomley, Bradford—Imp. in the manufacture of moreens and other fabrics of a similar character.
2452. H. T. Moret, 1B, Welbeck-street, Cavendish-square—The application of a mineral, named Deterso, as a disinfecting, preserving, absorbing, and curative powder.
2454. J. Tall, Collingwood-street, Blackfriars-road—Imp. in brushes or brooms for sweeping floors, carpets, and other similar articles.
2456. P. A. Mawdsley, Seacombe—Improved machinery or apparatus for drying yarns after being sized or stiffened, and the use or application of a certain substance or substances, in the sizing, stiffening, or otherwise preparing yarns and woven fabrics, or either of them.
2458. J. Fowler, jun., R. Burton, and D. Greig, Cornhill—Imp. in applying motive power to actuate ploughs and other agricultural implements.

Dated 24th November, 1858.

2460. E. Fielding, Todmorden, Lancashire—An improved method of preserving the form of cops of yarn by the application of adhesive substances.
2462. C. F. Vassero,, Essex-street, Strand—Improved driving machinery applicable for thrashing grain and other agricultural purposes. (A com.)
2464. J. R. Napier, Glasgow—Imp. in obtaining motive power by means of heat.
2466. W. T. Mabley, Manchester—Imp. in printing and dying woven fabrics. (A com.)
2468. I. Baggs, Kennington—Imp. in telegraphing by electricity.

Dated 5th November, 1858.

2470. W. H. Tooth, Lampeter-street, Islington—Imp. in the manufacture and construction of fire or furnace bars.
2472. T. B. Smith, Marietta, U.S.—Preparing wood, so as to be used as a substitute for curled hair, in the manufacture of mattrasses, and in the other purposes to which curled hair and its substitutes are applied.
2474. E. Rowland and J. Dewhurst, Manchester—Certain imp. in steam-engines, and in the valves connected therewith, which said improvements in valves are also applicable to safety valves.
2476. C. Mills, 8, High-street, Camden-town—Imp. in the action of pianofortes.
2478. S. Davey, Rouen, France—Imp. in blasting powder.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

2560. T. R. Butcher, F. Stevens, W. T. Johnson, and T. Jarvis, Frome, Somersetshire—Imp. in the hammer rails of pianofortes.—15th November, 1858.
2575. C. J. C. Perry, Williamstown, Victoria—An instrument to be used chiefly on board ship for approximating in certain cases the course of an approaching vessel, either in the day or night, and the relative angle of both ships' courses to avoid a collision, to be called "Perry's anti-collision dial."—16th November, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 19, 1858.]

November 19th.

856. J. M. Rowan and T. R. Horton.
1123. M. Brun.
1125. H. Brierly.
1131. F. C. Bakewell.
1136. S. Bryer.
1140. P. Féron.
1150. G. White.
1151. A. Ellissen.
1152. I. Baggs.
1164. G. W. Morse.
1192. W. Clark.
1226. J. Austin & J. Armstrong.
1235. J. Mannhardt.
1264. J. H. Johnson.
1980. A. V. Newton.
1990. W. E. Newton.

[*From Gazette, Nov.* 23, 1858.]

November 23rd.

1155. R. L. Hattersley.
1163. W. Webster.
1165. W. Webster.
1170. J. F. Belleville.
1171. J. Courage.
1184. P. A. Fourgassié.
1186. M. Henry.
1203. L. Tindall.
1217. M. Henry.
1219. J. Young and J. Strang.
1242. R. Roberts and W. Shaw.
1251. J. Mitchell.
1260. E. Cooke & G. Dickenson.
1331. L. F. Lemière.
1341. J. H. Young.
1347. J. C. Henderson.
1367. G. Davies.
1373. A. Dawson.
1379. R. S. Newall.
1397. J. Crossley.
1406. G. Schaub.
1429. J. H. Johnson.
1559. J. Loach and J. Cox.
1599. T. Bartlett.
1951. G. White.
1985. J. Sloper.
2135. A. B. Childs.
2153. R. Romaine.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Nov.* 19, 1858.]

November 15th.

2582. C. Crum and C. Paul.
2587. J. Yates and T. R. Birch.
2614. W. Harvey.
2856. A. Small.
2922. S. Sawyer.

November 16th.

2683. C. J. B. Barbier.
2799. R. A. Whytlaw and J. Steven.

November 17th.

2612. A. V. Newton.
2623. A. Tolhausen.

[*From Gazette, Nov.* 23, 1858.]

November 18th.

2541. T. Hitt.
2602. W. Smith.
2641. A. D. Lacy.

November 19th.

2617. E. O. W. Whitehouse.
2618. D. S. Price and E. C. Nicholson.
2619. D. S. Price and E. C. Nicholson.
2622. C. Defries.
2637. C. T. Dunlop.
2659. F. Coignet.
2664. J. Clark.

November 20th.

2631. J. Roberts, junr.
2639. C. May and P. Prince.

Journal of the Society of Arts.

FRIDAY, DECEMBER 3, 1858.

EXHIBITION OF 1861.

The following letter has been addressed to the Foreign Corresponding Members of the Society:

Society for the Encouragement of Arts,
Manufactures, and Commerce.

Adelphi, London, W.C., 1st December, 1858.

Sir,—I am directed by the Council of this Society to request your attention, as a Corresponding Member, to the enclosed resolutions,* having reference to another International Exhibition in London, in the year 1861, which have been made public.

It is perhaps unnecessary to remind you that the Society of Arts was the first to advocate the Exhibition of 1851, and the first to assert its international character.

The Society of Arts, from inquiries instituted, is satisfied that another Exhibition of Industry would be acceptable to the public of this country, and they believe to foreigners, and the Council are actively engaged in considering the best means of giving effect to the proposal.

Any Exhibition would be shorn of much interest and importance if confined to the produce of one country. It is of importance that the inhabitants of every country should become acquainted not only with what their fellow-countrymen can supply, but with what they can obtain from foreign countries.

The Council therefore desire to take the earliest opportunity of informing their friends in foreign countries of their views and desires, and though it would be rather premature at present to put forth any definite invitation for the year 1861, still it is only decorous to inform the industrial interest in every country of the proposal under consideration, and to invite their support.

Any communications which you may transmit, or which manufacturers or others may think proper to address to the Society, will receive the utmost attention, and materially aid the object which the Society has in view.

The Council would, therefore, be obliged if you would take means to give this communication every possible publicity.

In conclusion, the Council beg leave to say how happy the members of the Society will be to renew the agreeable and friendly relations established with so many distinguished persons in the year 1861.

I have the honour to be, Sir,
Your obedient humble Servant,
P. LE NEVE FOSTER, Secretary.

THIRD ORDINARY MEETING.

Wednesday, Dec. 1, 1858.

The Third Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 1st inst., Sir Thomas Phillips, Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Barber, Henry Charles
Benson, Henry Baskerville
Bonney, William Wolfe
Brocklehurst, Thos. Unett
Brown, Benjamin, C.E.
Clabburn, William H.
Clark, Thomas
Conybeare, H., C.E.
Cowie, Rev. B. Morgan
Danson, J. T.
Donald, William
Edwards, Frederick, jun.
Edwards, J. Passmore
Fletcher, John B.
Green, Daniel, jun.
Hartley, William, M.B.
Hudson, Stephen
Joubert, F.
Lankester, Edwin, M.D.
Merryweather, Richard M.
Mouat, Dr. Fred. John
Morgan, George
Neate, Charles
Nixon, Charles, C.E.
Norris, John G.
Ryland, Rev. J. H.
Scott, Andrew
Talbot, Capt. Hon. William
Wallace, Alexander, M.D.

The Paper read was—

ON COPPER SMELTING.

By Hyde Clarke, C.E.

Copper smelting is of considerable importance in England, not only because we smelt our own Cornish and other ores, but because we have also a large business in smelting foreign ores and refining foreign copper, which gives us a great command of the trade in manufactured copper; so that as well by our own advantages as the deficiencies of our neighbours, we obtain valuable results. Although the copper mines of England do not afford the rich ores of Lake Superior, or the Burra Burra, they abound in low sulphuret ores, which are easily smelted, and with the benefit of very cheap fuel, we are able to undertake the smelting of the rich carbonate ores of other countries on better terms than they can do it themselves. Many countries, rich in copper, have dear or scarce fuel, and dear labour, and must import their bricks and furnace cements, and thus it is found better to export the ore to the fuel, than to import fuel and carry it to the ore. Rich ores, too, in many cases are carbonates, which can be more conveniently smelted with the English sulphurets. Then, further, France, Belgium, and Holland are almost destitute of copper mines, so that the English have an opening there for manufactured copper, and compete in Central Europe with the Russian copper, or supply those countries with bar copper for refining.

With all these advantages it is still to be questioned whether the English copper trade has reached its height, or is free from vicissitudes. To suit the circumstances of local business a particular course of smelting by coal in reverberatory furnaces has been adopted; but this is not the most economical method, nor does it admit of the reduction of the lowest class of copper ores. It is quite possible, looking to the effective establishment of copper smelting in Chile, the United States, and Australia, to the abundant supply of rich copper ores abroad, and the competition of very cheap iron, that copper may be reduced in price, and thereby the working of the Cornish mines be threatened; but, on the other hand, if processes be adopted for the more economical reduction of copper, ores of lower produce or at lower rates can then be brought to market, and the reduction in price may be compensated. New combinations of copper, new alloys, as with silicium, will likewise open new sources of consumption.

At present copper smelting is a routine work, pursued on much the same plan as of old, and on the same general system in most of our works, followed out as a mechanical practice rather than as a scientific occupation; but the description of it is interesting, because it is continually undergoing modifications, which result in more economical working without much affecting the general system. There are several accounts of copper smelting, among which are those by the late Mr. John Vivian, the head of the great smelting firm, by M. F. Le Play, one of the most eminent mining engineers in France, who has most minutely observed the processes; by Dr. Percy, before the British Association; by Professor Warington Smyth, at the School of Mines; by Mr. C. Low, who has introduced several improvements; by Mr. Napier, the author of great improvements in smelting; by Mr. John Arthur Phillips, a member of this society, and by a writer in the *Mining Journal*, but no account has been laid before this society, and I have therefore taken the opportunity, in contributing this account, to bring it up to the present day. It will be seen that in the main it will agree with the authorities referred to, but with the difference resulting from modifications which, formerly matters of theory and experiment, have now been more liberally adopted. There is, however, one inconvenience in such a paper, that it does not admit of the minute details which are necessary to give a complete view of the processes. Thus, Le Play has devoted a volume to the subject, describing each operation as closely as he could; and so, too, my own materials have to be abridged to meet the space which is disposable. It is much to be regretted, however, that we have not in English a work on this subject as copious as Le Play's, with the requisite drawings on a large scale. To produce this, however, would require, as in his case, the aid of a government department.

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* See *Journal*, Vol. VI., page 333.

The copper smelting trade began in Cornwall, and was thence removed to South Wales, which until lately remained its sole seat, as it is its chief seat; but Liverpool having a great import of foreign and colonial copper ores and bar copper, has favoured the establishment of smelting works on the Mersey, and has a copper market, which is yearly growing in importance.

The classes of copper ores chiefly produced in this country are sulphurets which are made to average about 9 per cent. in the works. As sulphuret ores are more convenient for working in reverberatory furnaces, the smelters of South Wales and Liverpool are able to treat the carbonate ores from abroad, which are richer in metal, but less tractable than the sulphurets of copper.

The process of sampling copper ores in most of the copper countries of the world is now determined by the Cornish practice, which has been introduced, or is worked by Cornish samplers or by Welshmen trained under them. This process has been sufficiently described in works relating to mining, and provides for the ore of each mine or class being broken up about the size of a French walnut, or say ¾-inches, and formed into a separate pile. It is desirable the pyramidal pile should not be more than about a yard high, and the slope of the sides the natural batter determined by the stuff. A small pile is cut through with the sampling spade in four sections, by trenches, of about 8 inches wide at the base. The pile is cut thus, a b
c d
but if a large pile, thus a b c or a b c d
d e f e f g h

In each section, as for instance that of a, two portions are taken (with the shovel from bottom to top of the inner pieces of the section at each end. All these sixteen scrapings are brought together, forming so many vertical sections of the pile, and well mixed and ground up, being gradually reduced by dividing the mass into 4,

a b, taking away a
c d d

and leaving only b and c, which are mixed and again divided into four, when the process is repeated till the whole produce of the sampling is brought to a manageable weight, from which the small samples for assay are taken, and likewise a drying sample, to ascertain the proportion of moisture in the ore.

Although a pile of copper ore under 100 tons is only divided into four, when above that quantity it is always further divided.

Copper regulus for sampling is broken to the same size as copper ore, but on account of the greater value of the article it is usual, unless the pile is a very small one, to divide it into six or more plots.

Argentiferous copper ore or argentiferous copper regulus is broken smaller or even ground up, as there is a greater chance of variation in the average sample.

Abroad, where the ores are shipped in a rough state, and labour is not available for breaking up the ores, they are sampled by taking one bucket of ores in ten or twelve, and reducing these to a small sample, by continued subdivision and subtraction, as in the case of the Cornish process.

In shipping ores from abroad for the English market the qualities of ores in bulk are separated by matting on board; but the richer ores, as silver ores, are shipped in small hide bags, of local make, or in bags of sacking sent out from this country, and in which there is a considerable trade.

In sampling, much, with all the care that is taken, may be done by a little mechanical skill on the part of the sampler in handling and managing his shovel, and in taking and leaving richer bits of ore, which he knows by eye, to get such a sample as he wishes.

In the case of ores in all climates, or whether carried by land carriage or sea, there is always some proportion of moisture imbibed, which affects the net weight, and is ascertained by a drying sample, which is tried in an oven and reduced to a dry state, the difference of moisture being taken as the difference of weight.

This is not always the true difference, as other portions are volatilized besides water, and the difference is in favour of the smelting. In hot countries, ores are affected by heavy night dews, and by the muleteers wetting the ores on crossing streams. Ores in ships generally imbibe moisture.

It is to be observed that the drying sample is taken at a different time from the assay sample. The maximum moisture of foreign ores imported into Swansea is stated by Messrs. Richardson and Co., the eminent ore agents of that town, and by other local authorities, as follows:—

Chile ores	28 drams,	or	6 to 11	per cent.
Cobre ores.........	36	...	15	,,
Cuba precipitate	60	...	25	,,
Rough Chile regulus	9 to 10		3 to 11	,,
Rough copper ores	12	...	5	,,
Fine copper ores	22	...	9	,,

The minimum moisture abroad is:—

Rough regulus ...	1½ drams,	or	¾	,,
Rough ore.........	2	...	1	,,
Fine ore...	10	...	4	,,

The process hereafter described is an ordinary course of working poor Cornish sulphurets mixed with rich foreign carbonates; the furnaces being about 14 feet by 11 feet inside dimensions.

I. Process of Calcining Ores.

The first course is to calcine the sulphurets, so as to get rid of some of the superfluous sulphur. There are many modes of effecting this. Where there is not a populous neighbourhood, the simplest mode, and one sufficiently effective, is to roast the ores in the open air in a pile with brushwood or small coal. This is done, for instance, in the Alten Works in Norway, belonging to the Alten and Quænangen Company.

In some works, the calcining furnace is much the same as the other furnaces. In others it only varies by side doors being provided for rabbling or spreading the charge over the hearth.

Messrs. Vivian, in some of their great works, use what are called baboons, an old form of calciner, fixed over the furnace, into which they discharge the calcined ore hot.

It is usual to make calciners with double beds, because as a lower heat is required than for melting, the flame can, after being used on the lower bed of ore, be made to play on the upper floor or bed. A charge of ore is commonly laid on the top of the calciner in preparation for the upper bed.

Various plans have been suggested and tried for applying the spare heat of the smelting furnaces for calcining, but in England fuel is so cheap that it is preferred to burn coal rather than to resort to new and cumbrous arrangements. In many cases the wear and tear of the new furnaces would be more than the saving.

Under a calciner are vaults, called cubs, into which the calcined ore is let down and left to cool.

A calciner is sometimes very much larger in the floor than the other furnaces. Each charge put in a large calciner will be about four tons of ore fine dressed. It is first put on the top, and then passed in due course on to the upper floor, where the calciners are double. It is well spread over the floor, and about every four hours is turned over with a large rake, called a stirring rabble, introduced from the side doors. In six hours it is passed to the lower hearth through holes in the floor. In the first six hours' treatment little more is done than to warm the ore preparatory to the further calcining, as little or no chemical change takes place.

In the lower tier or hearth the charge is commonly left six hours, and is stirred every two hours, but as it is not stirred previous to discharge, it is only stirred twice. A charge is therefore passed through every six hours, but the time will vary according to circumstances. When the calcined ore is discharged into the cub, it is often cooled by water being thrown on it, and it is wheeled away to a heap for mixing, but in some cases is passed on direct to the furnace.

In smaller calciners than those here referred to, or in those of older construction, the charge will not be more than three or three and a-half tons weight. A difference in weight of charge will be compensated by difference in the size of the grate and the quantity of fuel consumed, so that the dimensions of the calciners might properly be adjusted by the proportions of calcining to the total work done.

For calcining the quantity of ore here mentioned with four charges a day, about one ton per day of coal would be burned, or about a quarter of a ton per charge of ore, or very nearly 1 cwt. per ton of ore; but as Sunday is a slack day, and the calciners are kept in heat, the rough consumption in a week may be taken at 7 tons, the number of charges at 24, and the weight of ore at from 90 to 100 tons. The number of working weeks in a year is about 48, but may be increased to 50.

If the ore calcined be a sulphuret of 10 per cent, though it is seldom so high, its constitution will be about, say:—

Copper	10
Sulphur	15 to 20
Silicious matter	45 to 55
Iron	20 to 25

About half the sulphur is expelled in the calciner or in the cubs, and a portion of oxygen is taken in and unites with the iron, and some chloride of sodium is obtained from the salt water thrown into the cubs.

Another class of ore may be thus composed:—

Copper	8
Sulphur	23
Silica	45
Iron	24

Mr. John Cameron, F.C.S., tabulates the results as follow:—

Original Form.		Converted into	
Sulphuret of Copper	8 Copper. 2 Sulphur.	8 Copper ... 2 Sulphur ...	Sub-sulphuret of copper.
Sesqui-sulphuret of Iron ...	21 sulphur 24 iron.	10 Sulphur..	Lost or replaced by
		5.40 Oxygen 12 Iron	Sesqui-oxide of iron.
		11 Sulphur.. 12 Iron	Sesqui-sulphuret of iron
Silica	45	45 Silica.	

In working a calciner, three men are employed for the day and three for the night, each gang under the foremen of calciners. The men are paid by the watch, and not by the charge, the operation being one of unskilled labour, and not requiring to be stimulated by piecework. The wages are from 14s. to 16s. per week. There is, in fact, no definite rule as to the state of the calcined ore, as it is not required to be exhausted of the sulphur, nor is any assay made to ascertain its condition.

II. Process.—Ore Furnace.

The second process is to put the calcined ore into an ore furnace.

The general form of a reverberatory furnace is about the same, and has remained so, from the earliest period of the establishment of copper smelting in this country by Sir C. Clerke. Some old drawings of Cornish furnaces are much the same in principle and general details as those of South Wales or Liverpool now. Further confirmation of this will be found in an interesting article on the early copper patents of Sir C. Clerke, in the "Mining Journal" of Nov. 27.

A furnace consists of a flat egg of the strongest fire-brick, supported by brickwork of ordinary bricks. Into this egg a large grate discharges the flame of a powerful fire, which passes along the upper inner surface of the egg, and is carried up a narrow throat or flue. At the bottom of the egg is laid the ore or metal to be operated upon. Such is the general structure of a furnace, but its details must be more closely examined.

It will be seen that its chief constituent parts are the grate, the furnace or hearth, and the flue.

The grate is a smaller structure added to the furnace at its back, open to the furnace on one side, and having on the three other sides walls roofed in at the top and open to the ashpit at the bottom. The size of the grate is chiefly dependent on that of the furnace; but it is varied by different engineers. According to an able practical authority, Mr. Alfred Trueman, C.E., the area of the hearth of the furnace being about 154 square feet, the area of the grate will be from 17 to 19 feet. The depth is not of so much importance as is the area of incandescent coal which supplies the flame. On one side of the grate is an iron feeding-hole, called a teazing pot, by which coal is thrown in. The grate is open to the furnace, but the communication is throttled by a thick wall called a bridge, which likewise forms the dividing wall between the grate and the furnace, and rises above the level of the hearth of the latter.

The ashpit under the grate allows the furnacemen to get down not only to remove the ash, but to rake the fire from beneath.

The furnace is of an oval or egg-shape but flat, and its capacity is diminished by sandbeds or bottoms. It consists, as already said, of a casing, which is formed of fire-bricks or silicious bricks, called the inside casing. The outer form of the furnace is, however, nearer to a square, and it is composed of less refractory bricks. This is called the outer casing, and the intervals between the inner and outer casings are filled in with old bricks.

On the hearth or floor of fire-bricks of the furnace, as already said, a bottom is raised for its protection. When a new furnace is started, it has to be annealed. This is done by keeping up a fire in the grate for about a fortnight, with the doors of the furnace off. No bottom has yet been put in. The doors are put up, and the furnace tested with a few hours good heat, to see whether there are any flaws or airholes. If found all right, and while the furnace is hot, a little slag, say sharp slag, is melted on the top of the bricks of the floor, say two inches in depth. Some sand is then thrown in gradually with the slag, the furnace being still in heat.

The first bottom is then put in, being fire-sand to the depth of about 18 inches. It is calcined for two hours, whereby the sand is consolidated, and the specific gravity increased. The men then level it with a rabble. The bottom is then smoothed down with a beater, giving it a little fall to the tap-hole. The doors are then put up, and a strong heat is kept up for twelve hours. A little metal or ore is next thrown in, which is melted in, say, a quarter of an hour.

The sand is then thrown in for a second bottom, to a depth of, say, 4 to 5 inches, and this is calcined for four hours. It is then levelled with the rabble and smoothed down with the beater as before; the doors are put up, and the bottom is melted for ten hours, and next the doors are taken down, and some metal is put on and melted for, say, half-an-hour. The doors are taken down, and the furnace cooled black, that is, to a dull red heat, for three or four hours, when a full charge is put in and melted, and the furnace is cooled down again, and next three charges are melted in succession. The furnace is cooled down again, and thenceforth thoroughly started.

The bottoms constitute one of the most essential details in the working of a furnace. In South Wales blown sand (or sand driven on the shore by the wind) is used, because it is nearest at hand and readily obtained. As much as seventy waggon loads a day are used by some works. This sand is inferior, because it is mixed with shells consisting of lime, which flux, but it is supposed that in the blown sand the shells, being lighter, are winnowed, and that the proportion of silex is larger.

Abroad shore-sand cannot be used, and fire-sand is imported from England. Fire-sand is likewise employed in some of the Welsh works. Such sands are found in several parts of South Wales, near Swansea and Neath.

This fire-sand is nearly silicious, but shore-sand blown is thus composed, according to one analysis:—

Quartz and silica	86
Lime	5·7
Magnesia	·8
Alumina	1·6
Oxide of iron	1·2
Carbonic acid, traces of water, &c.	4·5

The following are notes on some fine sands, obtained inland, and used for bottoms:—

No. I.—Cwm Joy, near Swansea.

Silica	92
Iron and Lime	11

This proved very bad, and, while used, came up almost every week.

No. II.—Sand from near Breton Ferry and Neath.

Silica	92
Iron and Lime	8

This did well.

No. III.—Pembre.

Silica	93
Iron and Lime	7

This worked very well.

Iron is considered more objectionable in bottom sands than lime.

The consumption of best fire-bricks yearly, in a furnace of the size recorded, including grates, will be between 7,000 and 7,500.

A single furnace, of the size already given, and a stack 45 feet high, used up—

Best Welch Fire-brick	2,288
,, Scotch ,,	5,816
Common Welch Fire-brick	13,271
	21,375

The bottoms in an ore furnace will often last twelve months, but in a like furnace seven bottoms have been put in in the same time. The only cause assigned for this latter case, was that a stream of air came in through a hole in a door, and regularly cut the bottom, which parted and came up. In a roaster, however, the bottoms are always giving trouble. It is always desirable to keep the lower bottom as long as possible, and only to replace it when the furnace is out, or repairs are on hand. The lower bottoms may be worked for years. The upper bottoms may, however, require renewal in three days or in three months. The breaking of a bottom suspends the furnace for some time, as it has to be cut to pieces with flowing bars, and got up. Letting out a furnace only for a day causes such injury to the bottoms, that they sometimes have to be removed or renewed. This will happen at stock-taking, when the furnaces are let down. This is one inducement to keep a furnace always under fire.

These bottoms absorb a considerable quantity of copper, which is thereby kept locked up in the furnace, and this prevents the double disadvantage of dead capital and of uncertain quantity.

The furnace requires a bin or hopper at the top, to put in the charge of ore, and has a tap-hole formed at one side, which is only opened for letting out the molten regulus. The front door, for stirring and rabbling, will be described with the flue.

The outside casings of the grate and furnace are not dependent solely on the cohesion of the bricks, of which the fire-bricks are cemented with fire-clay and fire-sand, but they are fastened by cast-iron studs or upright posts of iron, a foot or two apart, and bound together at top by bars of iron, called cramps, or clamps. Thus, a furnace is bound together in an iron cage, but it does not nevertheless withstand the violent action of the fire.

The flue springs from the narrow front of the furnace by what is called the uptake, up which the flame proceeds, and the flame and smoke are thence carried to a short stack or down into the central culvert. The front door of the furnace is under this flue in the front wall, and when the furnace is at work, it is secured by a door or slab of fire-pottery, which can be removed to enable the smelter to work the charge.

The grate is, as stated, a square, hollow chamber. It has at the bottom two strong iron bars or sleepers. Regular furnace bars are not used, but loose bars of old iron are laid on the sleepers. The place of furnace bars is really supplied by a clinker bed. The coals commonly used for smelting in South Wales, erroneously described in most works as anthracite steam coal, include a considerable proportion of clinker, and advantage is taken of this to build up a porous red-hot substratum of clinker, by leaving always a considerable portion of clinker in the grate. On the top of this the coal is burnt, and the height of the clinker grate is kept down by getting out portions from below the ashpit, and more particularly when a large clinker has been formed. It is for this reason that loose bars are used.

This clinker grate is porous, and has channels through it, up which the atmospheric air passes, and is heated before reaching the burning coal in passing thence to the furnace. When needful for this purpose the clinker grate is opened up with a pricking bar from below. This method has one disadvantage, that small coal will run through a large channel without being consumed, but are wasted in the ashpit. This may be remedied by greater care.

One advantage of this method is that almost any kind of coal or slack may be used for smelting. Generally the coal is the refuse of the collieries, if any vend can be got for the larger coal, and slack has been exported for foreign collieries. Any free burning coal will do, if cheap enough, but if used alone it is rapidly burnt up. It will be seen that the coal has to perform a double function, to pour flame into the furnace, and to keep up the clinker grate, and therefore, where it can be done, it is found most useful to mix a free burning and a binding coal, so that the latter may clinker and bind together, besides giving its share towards the combustion. A coal altogether binding can be worked, but is not found good. Anthracite does not work well. A good mixture is one of binding and two of freeburning.

The best coals, binding and freeburning, are perhaps those of South Wales. Newcastle has good freeburning and some binding—the Lancashire coals are inferior. Artificial fuel has been used, but there is a prejudice against it, as the men do not like to handle large blocks or large coals, but like to have them ready broken.

In our works the supply is mostly obtained from collieries leased by the copper companies, and as the best qualities are sold for shipment, the smaller coal comes cheap, and but comparatively little attention is paid to its quality or consumption. There is most frequently no choice as to quality, and it is so cheap that its consumption is not closely supervised. It is, however, very doubtful whether slack is really economical, for good coal forms smaller clinkers, having less refuse in it, and is more economical of coal, whereas small coal and slack form very great clinkers, and interfere with the healthy working of the furnace, with good coal, the fire is pricked about twice in each watch, but with bad coal oftener.

With regard to the square form of grate, my opinionl is that there is a space not fully occupied by the fire, which is lost, besides the grate being there liable to injury, and in 1855 I suggested that the back should be rounded, and this has been tried.

In working the ore furnace, the charge will vary according to the class of ores, and the furnaces, and the weight according to the size of the furnace, from 3 to 3½ tons, or in large furnaces rather above, but dependent on the fusible proportions of the ore. Calcined ores are more favourable, but the practice is at this stage to introduce raw carbonates, so that the following will give a good specimen of a charge.

Calcined ore	36 cwts.	Raw ore 26 cwts.
Sharp slag	8 ,,	
Total	44	
Add	26	
	70	

The proportions of sharp slag may be made much higher, and of course that of calcined ore.

Of this total weight it is to be observed, the slag is seldom weighed, but is computed; the ore is counted to the men as 22 cwt. to the ton. Two hundred weight in some works, and one hundred weight in others is carried at once.

The mixture of the charges is one of the chief points in good smelting, and taxes the skill of the managers, for many classes of foreign ores are brought into our smelting works, and in some countries abroad a great variety of ores is found and smelted. In other countries the quality of the ores is tolerably uniform, and the course of working is very regular. Where new ores are received, several trials may have to be made before the working is good, and sometimes the charge is worse at the end of the time than in the beginning.

In the early stages of copper smelting, the object of the manager is less directed to any operation on the copper, to the manufacture of copper in fact, than to the manufacture of slag, for the removal of silex depends on a good silicate of iron being formed, which will freely flow out separate from the regulus. This is an essential point to bear in mind, for the slag may be pasty, and so carry off a portion of the metal, or it may be full of shots of copper and so wasteful, while the object is to get rid of the silex with as small a quantity of the valuable article copper as may be. A good clean slag is, therefore, the satisfactory test of working, and the slags are anxiously examined by manager and men.

The charge of ore is put in through the bin or hopper at the top of the furnace, and is spread over the hearth, or rather bottom, with the rabble. The slag is thrown into the furnace through a side door, in large lumps. All the doors are then luted on tight with fire-clay, and the charge is melted for about five hours, when the furnaceman starts his fire afresh.

About this time he begins the moulding of his metal beds, and his slag beds, which are formed of sand, the metal beds near the tap hole, and the slag beds before the fore-door. Any kind of common sand, dry, will do for these beds, as the moulding is rough.

Commonly about the end of five hours, the furnaceman takes off the fore-door, which is burning hot, with an iron rod. He stirs the charge through the fore-door with a long rabble down to the bottom. If the charge is all right and thoroughly melted, he puts up the door and gives ten minutes for the metal to settle down to the bottom. The door is then taken down, and the slag is skimmed off with the skimming rabble through the fore-door into the slag-beds. The slag is run over the lower bar of the door, which is above the level of the bottom. The man can see the bright level surface of the metal, and observe by the eye whether it is clear of slag. It is his object to get the molten metal free from slag, and the slag free from copper; and more particularly, as all slags found to contain more than an allowed portion of copper have to be smelted by him free of charge. These are the checks for good working.

The metal is tapped into the regulus into pigs, but not until there is enough regulus from several charges.

In this process it is sometimes necessary to add fluxes to the charge, as fluor spar, lime, shells, shelly sand, cinders, anthracite coal. Fluor spar is obtained from Cornwall, and M. Le Play estimated the consumption in South Wales at 7,800 tons yearly. At present some works use no spar, and others not more than one hundred tons yearly. Shells are not used in this country, nor are carbonaceous fluxes esteemed.

Five charges can be put through a furnace in a day when the ore is good, and sometimes six. The work goes on night and day except on Sundays. The men are paid by the ton of ore in the charges, the ton being reckoned at 22 cwt.; the rate is now about 1s. 6d. per 22 cwt., or 2s. 9d. per 33 cwt., and a man's earnings are about 28s. per week. The men are one for the day and one for the night. The men of neighbouring furnaces help each other. The consumption of coal, working from four to five charges, will be from 25 to 30 tons per week.

The stuff put into the furnace will be, say—

Copper......................................	10¼
Silica	55 to 65
Iron	34 to 39
Sulphur	7½ to 10½

The produce is—

COARSE METAL.

Copper..	10¼ to 11
Iron	10¼ to 15
Sulphur	10¼ to 7

SLAG.

Silica..	55 to 65
Iron	24 to 29

with a trace of antimony and tin.

The slag is a protosilicate of iron (34·62 protoxide of iron, and 65·38 of silica) with nodules of silex imbedded.

III. CALCINING POWDERED REGULUS OR COARSE METAL.

One of the old processes was to run the regulus or coarse metal not into beds, but into a basin of water or cistern, in which it was granulated. A part of Napier's improvements consisted in dispensing with this by a chemical mixture, but Mr. Alfred Trueman further improved by stamping the regulus to powder.

The powdered regulus is put into a calciner, which is the same as an ore calciner, and the general mode of treatment is the same.

The charge put in is from 3 tons to 3½ tons, weighed out 2 cwt. at a time. The charge is put on to the roof, and so passed on to the floors. It is spread in the same way, and stirred every second hour. One charge is passed through in twenty-four hours, the calcining taking double the time of ore. At the end of the time, the regulus powder is cast into the cubs. Some sulphur is discharged in the cubs in vapour, which is passed through the cub dampers into the culvert.

The weekly consumption of coals is about seven tons. Inferior coals may be used for calcining ore or metal. Bituminous coal will do for this.

Two men are employed for the day watch, twelve hours, and two for the night. Their pay is about 18s. to 20s. per week.

About six charges are passed through in a week; the powder calcined, being a regulus of, say—

33 copper,
33 iron,
33 sulphur,

has lost the greater part of its sulphur, and acquired oxygen, forming oxide of copper and oxide of iron.

IV. Melting Calcined Coarse Metal.

The furnace is the same as an ore furnace.

The charge is made up to a total weight of about 52 cwt. There is here an opportunity of introducing raw ore again as rich carbonates, and the following will represent a charge:—

Calcined powder	24	cwts.
Foreign raw ore	24	,,
Refining, or roaster slag	4	,,
Total............	52	,,

Another example is:—

Calcined powder	23	,,
Foreign raw ore	24	,,
Refining, or roaster slag......	5	,,
Total	52	,,

Another example is:—

Calcined powder	20	,,
Raw carbonates	20	,,
Refining, or roaster slag......	8	,,
Total............	48	,,

Of these the charge may be made up with calcined powder and slag, and this is the case abroad, but English melters have to work up a great quantity of foreign ores, which they are thus able conveniently to introduce.

The ores in the charge are well mixed together in the ore-yard before being supplied to the men.

A charge is in about six hours, and is treated much in the same manner as in the ore furnace. The slag is skimmed in the same way, but the regulus, being more abundant, may be tapped every second charge.

The coal consumed is about four or five tons a day, or about thirty tons a week.

There is one man for the day watch, and one for the night watch. One furnace will pass through about 2,200 tons of ore, holding about 700 tons of copper.

The result is *blue* or *fine* metal and sharp slag.

The metal consists of,

Copper	70 to 83
Sulphur	30 to 17

The *sharp slag* consists of:—

Protosilicate of iron, with some copper and antimony.

The slag is so called because it is bright, breaking into sharp-edged fragments. They contain no shots inside, but small shots sometimes on the outside.

V. Process.—Roasting Fine Metal.

A roasting furnace or roaster is the same as an ore furnace, but has no bin, as it is charged by the side-door. There is an airhole in each back corner, called a porthole, which leads on to the furnace floor.

The charge put in is from 3 to 3½ tons of metal, rough weight, or enough to produce 2½ to 3 tons of copper. The charge is in about 24 hours. Each pig of metal is put in with a paddle. The portholes are partially opened, and fire is gradually raised for the first eight hours, and the metal kept red-hot. The fire is then raised a little for another eight hours, so that the metal will sweat down. The portholes are closed and the doors luted tight, when the fires are raised and driven on until the charge is thoroughly melted on the bottom. About the nineteenth or twentieth hour the front door is taken down, and the metal is stirred with a rabble. If all appears clean, the small quantity of rich slag produced is skimmed, and if the metal is clear it is tapped, if for export, as in foreign works, into iron moulds as pimpled bar copper, but if to be carried to refined, it is tapped into beds as pigs for the next roasting.

The quantity of coal consumed is from 22 to 25 tons per week.

The men's wages are about 3s. to 3s. 6d. per watch.

VI. Process.—Second Roasting.

When fuel is abundant and working careful, the metal is subjected to further treatment, and sometimes to a further roasting of twelve hours.

VII. or VIII. Process.—Refining.

The refinery furnace is the same in form as the ore surface, but is smaller, and has no bin or tapping-hole, being charged from the side door, and ladled out from the fore door.

The charge in a refinery furnace will vary from five to six tons of pimple copper in pigs. One charge is put in each day. The metal is melted fiercely for several hours and skimmed for the slight slag. Air is let in from the side door till the copper begins to "work" or coil up, and when the refinery man, with a little rabble, moves or flaps the surface a little. The "working" is continued for two hours, when the copper is seen to "blister" or rise in black scales, having become blistered copper. The man keeps the side door down, and lets the copper solidify according to circumstances, 2, 3, 5, 6, or 7 hours. The doors are then luted, and the metal melted afresh for 3 or 4 hours.

The head refiner now takes charge of the operations, and proceeds to take a small test in a ladle, which is worked into an ingot and tried on the anvil. If found fit, lead is put into the surface, about 16lbs. to 6 tons of copper, and some charcoal is spread over the surface of the copper, and, further, the copper is stirred with a stout pole. He continues to test the copper, and as he finds the "pitch" or grain so he backens or forwards the operation, and gives air or poles more.

The refined copper is cast into ingots, tiles, or wire bars, according to the demand. It is sometimes refined a second time, if "best select" is to be produced.

In making bar copper for sale on a large scale, it is a practice in some countries to mark the bar with the maker's name in the casting, and likewise the number of the charge, so that a quantity may be dealt with as of one make. Sometimes the number is punched.

Bar copper is sampled for sale according to a plan practised by Mr. Hussey Vivian, by drilling a hole, of from one-eighth to half an inch diameter, half-way through the bar from the top, and another half-way through from the bottom, but not so as to meet, as they make two half-sections, and thus afford a better average section, The drill is worked in a frame. The filings so obtained from each bar drilled are divided into four parts, a, b, c, and d; a and d going to the buyer, and b and c, as samples, to the seller, and from the total samples is taken, alternately, a check sample, under the seals of the buyer and seller.

The drilling is rapidly done. The quantity taken is about one dram for each cwt., where the bars are of one charge or smelting, so that the total shall not be less than 240 drams or one pound weight, all the drillings are well mixed together. The drilling from 4 cwt. would be 240 drachms and from 16 tons of the same charge about 320 drachms.

The following is an analysis of select copper:—

Copper	99.80 to 99.85	
Iron	0.10 to 0.15	
Lead Antimony	nil.	nil.
Oxygen, of no consequence.		
Silver do. do.		

Select copper, as follows, will not sell:—

Copper	99.85
Iron	0.10
Antimony	0.01

or, even a trace of antimony.

The following is an analysis of the very best cake copper:—

Copper	99.60 to 99.70
Iron	0.10 to 0.15
Lead	0.10 to 0.15
Antimony	0.04 to 0.06
Silver (objectionable.)	

The average consumption of coals to a ton of copper is about 10 to 15 tons per ton of pure copper, depending on the per centage of the ores, and the goodness of the coal.

Mr. E. J. Cole, Secretary of the Alten Copper Company at Norway, and the Copiapo Company of Chile, who has been long connected with the smelting interest, has been kind enough to give me for this paper some particulars of the working of copper in Norway:—

"The following will give you some idea of the business at the Alten Copper Works:—

"The quantity of ore reduced in 1857 was 1,899 tons, $\frac{822}{1000}$, producing 123 tons of fine copper, the average quality being $6\frac{47}{100}$.

1874 tons, 036 ore, 402 tons, 600 metal slags, 19 tons, 000 sweepings,	Were reduced in the ore furnaces, and consumed 1464 tons of coal.
418 tons regulus, 25·786 tons ore, 57·820 tons refinery & roaster slag, 73·800 tons furnace bottoms,	Were reduced in the metal furnace, and consumed 224½ tons of coal.

212·500 tons white metal were roasted, and consumed 185 tons of coal.

128·000 tons black copper were refined, and consumed 34 tons of coal.

"You will thus see the process of reducing the ore to fine copper, and the consumption of coal in each reduction.

"The cost of coal, as you are aware, delivered at Alten, is about 12s. per ton. Some time ago we were able to secure freights very low, and we then had the coal delivered as low as 8s. to 9s. per ton. The great expense of reducing ore is in the first process, where the largest quantity of coal is consumed, and when the ore is reduced to regulus; the after processes are comparatively easy.

"The cost of reduction in 1857 was, per ton of ore, 28s.; per ton of copper, £21 12s.

"At Alten we, fortunately, have various descriptions of mineral, and are able to make good fusible mixtures; hence we obtain, as we consider, very satisfactory results, and our copper ranks equal to the best selected, and a good market is always obtained."

Furnaces.

A double-bedded single calciner, 30 feet long over casings, exclusive of grate, and 14 feet wide, will require, besides the bricks of the stack or culvert, about 50,000 bricks, fire and inferior qualities, but in which old bricks can be worked up; 2 tons of best fire clay and 8 tons of common fire clay; 80 bushels of lime; 120 bushels of sand; a small quantity of fire sand; about 40 tons of stone for foundations (but this depends on circumstances); of sundry clay pottery, 200 or 300 soaps and as many splits; 20 slabs and 20 bearers. The wages will be, mason 156 days, boy 156 days, labourer 48 days, besides head masons and smith for the smiths' work. The time in building will be about 20 days, exclusive of odd jobs in finishing off and setting the calciner going.

The iron work for such a calciner, consisting of cramps, studs, door frames, plates, bearing plates, sleepers, teasing hole, sliding frames, and slides, will vary according to the mode of construction adopted in the several works. The smiths' time in fitting would be seven days, and a labourer seven days.

A single double-bedded calciner will take about 24,000 fire bricks and 1,200 red bricks, 2 tons of best fire clay, 8 tons of common clay, and other materials as before. The labour will be less, both of masons and smiths, in proportion to the difference of materials.

The grate will be about the same as the grate of a furnace of like dimensions.

The stack will be the same as for other furnaces and its cost will be according to the system of stacks adopted.

Furnaces are worked with stacks according to various plans depending on the circumstances of the works, or on the fancy of the owner, manager, or mason. Some work the furnaces with a stack for each pair of furnaces, and some have all the flues brought by an underground culvert to one central stack. In the Cwm Avon Copper Works of the Copper Miners' Co. of England there is not one stack on the premises, but all the furnaces communicate with one common culvert, which is carried for a distance of about a mile and a quarter up the side of a mountain, whence the smoke is carried up a stack forty feet high on the top, forming a conspicuous sight for miles around, and with a draft strong enough to carry a man up into the air. This volcano can be seen for a considerable distance on a clear night, and on a fine day from as far as Tenby. A man took a contract for clearing out this culvert on condition of having the culvert stuff for his remuneration, presuming that it contained the usual average of copper throughout, as a considerable quantity of copper goes up the stack. The contractor, however, made an unfortunate bargain, and abandoned his contract, as the chief stuff was sulphur and arsenic.

In some works a central stack and single stacks may likewise be found, but the balance of experience is not in favour of either system so as to secure its decided adoption. The objection to a central stack and long culvert is, that the draft of individual furnaces is sometimes interfered with, and therefore stacks for each furnace are by some preferred. The advantages claimed for the central stack and culvert, are, that an inferior draft is obtained and that the copper passing out of the furnace in fume is saved; it is certainly true, that in a single stack but little stuff is saved, whereas in a culvert there is always stuff containing copper which can be smelted.

An objection taken to a central stack is, that it may interfere with the working in case of repairs, but if there be one line of culvert running between the furnaces, and at each end of the culvert a high stack, then, by means of a brick partition set up in the culvert, the number of furnaces to each stack may from time to time be variously apportioned, particularly during the repair of end furnaces, then all the remaining furnaces may be put on one stack. The draft of a central stack will be affected by the greater or less number of furnaces working on it, and this is felt to be an inconvenience by the smelters.

One circumstance that will affect the height of stacks is the situation of the works. A number of high stacks belching forth sulphur and arsenic night and day destroy the vegetation of the neighbouring fields wherever the pestilent breath touches, the field being stripped of herbage, as if by locusts, and brought to the appearance of a bed of shingle. Copper works, are however, mostly situated in waste districts.

Much attention has been given to this evil, and the great waste of sulphur and other substances carried off in smoke, and many plans have been proposed for their recovery, but as yet no particular result has been obtained. There is no question that the loss is very considerable, forming part of that great waste of residuary matter which meets with too little attention in England.

A stack 50 feet high, and with an inside lining of 50 feet and outside lining of 30 feet, will, exclusive of foundations, require 3,100 fire bricks for the inside lining, and 2,500 common red bricks for the outside, $2\frac{5}{8}$ tons of common fire clay to be used inside, up to a height of 30 feet, 20 bushels of lime, 40 bushels of sand, and a little fire-sand for mixing with the clay. The wages will be, mason 24 days, boy 24 days, and labourer 21 days, besides superintendence; the time in building will be 9 days. All this is exclusive of foundations, which vary according to situation.

Such a stack is rodded or cramped with iron rods, for better security against the action of the furnace flames passing through, and there will be used 530 feet—$\frac{5}{8} \times \frac{5}{8}$ square, for rods, 400 feet $1\frac{1}{4} \times \frac{1}{4}$ flat for cramps, and 200 feet 3 inches by $\frac{1}{4}$ flat for cramps, beside a quarter of a hundred weight for wedges. The smith and his labourer's time will be 9 days.

The cost of a furnace will vary according to its purpose, its situation and its dimensions. The following is for a large reverberatory furnace:—Outside dimensions over casings 22 feet 6 inches length, 15 feet width, add for grate 6 feet 2 in length by 8 feet 8 in width. Height of casings, from the floor at the grate end, 5 feet 11 inches, at the fore part 4 feet 6 inches. Inside dimensions of furnace 14 feet length by 11 feet width. Thickness of inner and outer casings at the side, 2 feet, of jambs and sides of grate 2 feet 1 inch, of back of grate 9 inches.

Such a furnace would require about 8,500 fire bricks and 3,500 common red bricks, and about 3,000 old bricks might be used up; of fire clay, best, 4 tons, and common 7 tons; of lime, 80 bushels; of sand, 120 bushels, and a small quantity of fire sand; of pottery, 200 soaps or closers; 200 splits, 8 slabs of various dimensions, and twelve bearers, whole or in halves. The wages will be, mason 60 days, boy 60 days, labourer 60 days, exclusive of superintendence. Such a furnace can be built in ten days, exclusive of odd jobs and finishing off.

The iron work for securing the furnace will be as follows:—*Wrought iron*, 260 ft. 1×1 square bar, 100 ft. $\frac{1}{8} \times \frac{1}{8}$ square bar, 100 ft. $\frac{3}{4} \times \frac{3}{4}$ square bar, 26 ft. $1\frac{1}{2} \times \frac{5}{8}$ flat, 100 ft. $1\frac{1}{4} \times \frac{1}{4}$ flat, 80 ft. 3 in. $\times \frac{1}{4}$ inch flat; 8 ft. $1\frac{1}{2} \times 1\frac{1}{2}$ square bar; 4 studs 9 ft. long $\times$ 3 $\times$ 3 in.; 2 studs 5ft. 6 $\times$ 3 in. $\times$ 3 in; piece of wrought iron 5 ft. 3 in. $\times$ 3 in.; teazing pot; stuff for wedges. *Cast iron:*—14 studs $6\frac{3}{4}$ ft. $\times$ 3 in. $\times$ 3 in.; 7 studs 6 ft. 3 in. $\times$ 3 in. $\times$ 3 in.; 12 studs $5\frac{1}{2}$ ft. $\times$ 3 in. $\times$ 3 in.; 1 bearing plate 6 ft. $\times$ 9 in. $\times$ 2 in.; 3 sleepers 6 ft. 4 in. $\times$ $4\frac{1}{2}$ in. $\times$ $2\frac{1}{2}$ in.; 1 bearing plate 7 ft. $\times$ 9 in. $\times$ 2 in. 1 concave or convex plate $7\frac{1}{2}$ ft. $\times$ 30, $\times$ $3\frac{1}{2}$ and $1\frac{1}{2}$ in.; 2 fore-plates, 5 ft. $\times$ 20 in. $\times$ 3 and $1\frac{1}{2}$ inches; 2 skimming plates, 3 ft. $\times$ 7 in. $\times$ 3 in., made in three plates each. The wages will be—smith, for fitting, 14 days, and his labourer 14 days. The particulars and dimensions of this ironwork will vary according to the fancy of each manager.

In some of the latter works the furnaces are still found cased in a jacket of thick iron slabs, secured by the studs, but it is not a good plan, as defects in the brick work cannot be so well seen, and airholes may thereby escape notice, nor is the furnace stronger, cheaper, or more durable.

A furnace exposed to the intense heat of copper smelting is always in process of consumption, and its repairs are continual. The outside casings will last five years, which is about the longest life, but the inner portions are perpetually burnt up. A grate will last at the least 8 weeks, at the longest 13 weeks, so that there will be 6 grates in a year. The inside of an ore furnace with repairs will last from eighteen months to two years, but of a metal furnace only from nine to twelve months.

In a subject so extensive as this omissions are more likely to be noticed than what is described, but the commercial portion of the transactions is both important and considerable, and would require a paper by itself; and it is the more deserving of notice because the profits of the copper business depend more on good trading than on manufacturing cleverness.

DISCUSSION.

Mr. CHARLES LOW wished to make a few remarks upon the very interesting paper that had just been read. The subject of copper smelting was a most important one, as it embraced one of our largest manufacturing interests, and it was a manufacture that had had fewer improvements made in it since its first commencement than any other in this progressive country. In fact, it might be said that since its first introduction little or no permanent improvement had been effected. This arose principally from two causes, the first of which was that the copper smelting business was a complete monopoly in the hands of about ten individuals, who entirely ruled the trade as regarded the prices to be paid for copper ores and other matters, and who were also extremely adverse to any kind of improvement being introduced into the manufacture of copper, and would, moreover, throw every possible impediment in the way of such being carried out. The next difficulty was, that although most important discoveries might be made in the laboratory, it was frequently the case that it would not be possible to carry them out on a large scale on account of the expense attending the process, or the impossibility of obtaining the use of works to make the trials. It must be also borne in mind that the material to be operated upon was of great bulk, the matrix of the ore being so out of all proportion, when compared to the quantity of metallic copper produced. The average produce of copper ores, produced from English mines, did not exceed $6\frac{1}{2}$ per cent., and when the produce of the foreign copper ores imported into this country was added to it, the produce of the whole would not quite average 10 per cent.; so that, for every ton of fine copper produced, at least ten tons of ore must be smelted. From this it was obvious that, to treat such a vast bulk of material the cheapest possible process must be adopted. From a description of the present process of copper smelting, in the paper just read, it appeared to be as nearly as possible the same as was carried on at one of the earliest copper-smelting works, erected at Bristol, upwards of 100 years ago. The ores were submitted to from seven to ten different processes, from the time they were first placed in the calcining furnace until they were produced from the refinery in the shape of fine copper, and this occupied ten days. Now to carry out this long process it was obvious that the cost of coal, labour, wear and tear of furnace, and other matters, was very great, and any improvement that would tend to lessen this was most important. Some attempts had been made for the reduction of copper ore by what was called the wet method, by means of acids, but this had failed, owing to the bulk of materials to operate upon being so great, and rendering the process too expensive. Having had much experience in metallurgy, and particularly copper smelting, he (Mr. Low) was induced to go into the matter very closely, and, after first ascertaining the exact effect required to be produced upon copper ores by submitting them to the present protracted operations, then to ascertain whether some other method could not be used by means of the application of proper fluxes to effect the same object more economically. In the first place, what was the effect intended to be produced by the present method of smelting? It was simply to desulphurise the ores and deprive them of the iron contained therein by oxidation. This was at present effected simply by heat, applied during a series of long and expensive processes. After much research, he (Mr. Low) had discovered a plan of operation, which obviated these difficulties, and which he patented. The process was as follows :—The ore was first calcined in the ordinary mode, and then introduced, likewise in the ordinary way, into a reverberatory smelting furnace and smelted, and, after skimming off the slags, was run out into sand-beds, not into water, as just mentioned in the paper read, which in his (Mr. Low's) opinion was useless. The metal thus produced was a regulus. It was then placed in another reverberatory furnace, which was constructed with orifices on each side the bridge of the furnace to admit a current of air; this improvement being also patented. The current of air passed between the flame and the surface of the melted metal, and impinged on the latter, greatly assisting the operation. The flux, consisting of certain proportions of manganese, plumbago, carbon, and saltpetre, was then introduced, and the effect produced was that the iron, sulphur, and other extraneous substances were oxidised; the copper was set free and brought into a metallic state, and at the end of twelve hours was fit for the refinery, so that by this process the finest copper could be produced in 36 hours which, by the ordinary process, could not be effected in less than ten days. The saving of coal, labour, and other matters would be obvious to all. This process was not a mere theory, but had been carried on by him upon a very large scale, and many thousand tons of fine copper made by it. In conjunction with others, he had erected large copper works near Swansea, and fully carried out the process, and it was found that the copper produced was of very fine quality, and sold in the market £2 or £3 per ton higher than the finest copper produced elsewhere; moreover, the cost of smelting by this process was 50 per cent. less than by the ordinary method. This success naturally brought upon him the opposition of the monopolists, and every attempt was made to drive himself and partners out of the trade, and, of course, at last with success. The price of copper was lowered to an unprecedented extent, and the price of ore raised, so that it was quite impossible to continue their operations except at a loss; and, in order to avoid losing the whole of the capital embarked, they determined upon discontinuing operations, but not until the success of the process was completely established. He mentioned the fact of the success of this improvement principally for the purpose of showing how much might be done towards a cheap production of copper, and he believed it to be but a small step towards further chemical discoveries, which would effect a far greater saving. The position in which one of our most important industrial commercial interests was placed by the existence of such a monopoly was, indeed, to be regretted. Our mining interests were, in fact, at the mercy of certain parties to give any price they might think proper for the ore produced, and, according to a calculation he had just made, he found that the profit made by the copper smelter upon every ton of fine copper produced was £40, after paying all charges, and as the quantity of fine copper produced in this country exceeded 30,000 tons per annum, they might calculate the princely revenue that accrued to the monopoly. But there was a remedy that could easily be adopted to meet the difficulty. Let a few influential owners of mines combine to smelt their own ore by a cheap process, either in Cornwall or elsewhere, and the monopoly would very soon be at an end. The smelter would still have ample profits, and the miner receive a proper and just remuneration for his outlay of capital and perseverance.

Mr. J. Arthur Phillips, having been requested by the Chairman to give some information relative to the various humid processes now employed for treating copper ores, described the method made use of at Riotinto and various other localities, for the treatment of the poorer sulphides of copper, by cementation. Mr. Phillips subsequently described the process of Mr. Rhodins, of Linz, on the Rhine, by which the copper is extracted by the aid of sulphuric acid, derived from the sulphur of the ores themselves. The processes of Mr. Sinding, for the precipitation of copper from its solutions by means of sulphuretted hydrogen, obtained by the decomposition of the gases, yielded by the dry distillation of fuel when passed through pyrites heated to redness, were also given, as well as the method of treating the cupreous sandstones of Twista, in the Waldeck, by hydrochloric acid, and subsequent precipitation of iron. Mr. Phillips also described, and made some observations relative to, the copper deposits of Tennessee and Virginia, United States of America, which, he was of opinion, were the result of decompositions of a secondary nature, and which were, in all probability, still actively progressing.

Mr. Murchison was sure he expressed the opinion of all present when he said that Mr. Hyde Clarke had shown himself to be completely master of the subject which he had so ably brought forward that evening. There was one point in the paper which had particularly struck him (Mr. Murchison), namely, that, "At present copper smelting is a routine work, pursued on much the same plan as of old, and on the same general system in most works, followed out as a mechanical practice rather than as a scientific occupation." This statement had been fully confirmed by a previous speaker (Mr. Low), who was practically engaged in the trade. He (Mr. Murchison) recollected reading an article in one of the daily newspapers, a few years ago, with reference to free trade, in which the writer expressed an opinion that, in a very short time, a protectionist would be so rare a creature, that his proper residence would be the British Museum. The writer, however, had evidently forgotten the copper smelter, in as much as they found that the process now in practice for copper smelting was the same as that adopted at its origin 150 years ago; so that, whilst all other businesses and professions had undergone a complete revolution, and whilst the advancement of science had enabled all manufacturers, except the copper manufacturer, to progress, yet the copper smelter adhered to his antiquated notions, and preferred the good olden time. He believed that it was in the year 1708, when the first piece of copper was manufactured in Cornwall, by Sir Talbot Clerke; and many other attempts were made to carry on the smelting business there; but it was not until 1720, or 1726, that copper mining in Cornwall enabled the smelting trade to assume any degree of importance. In the year 1726, the total produce of the copper mines of Cornwall was about 5,000 tons. In 1750, it increased to about 10,000 tons; and in 1754, the first smelting works were erected at Camborne, in Cornwall, which were afterwards removed to Hayle, to be nearer the port of shipment and nearer also to the fuel. An opinion had been expressed by Mr. Low, that if the copper miners of Cornwall adopted the plan of smelting at the mines they would find it most lucrative. He believed that as much as 100 years ago that plan was attempted by some of the principal copper miners of Cornwall, who not only endeavoured to calcine the poorer ores, but also to bring the ore into a state of regulus; but, such was the amount of opposition offered, that the project was abandoned—for the reason given by the smelters that the two processes performed upon the ore by the miners interfered considerably with the large profits made by the smelters. From Cornwall the smelting trade was carried to Bristol, but it was soon found that the cost of the double freight of the raw produce to and from Bristol, added to the cost of fuel from Wales, was a commercial mistake, which led to the trade being carried to Swansea and Neath. In later years the copper mines of Cornwall had rapidly increased, until, at the present time, as much as 150,000 tons of copper ore were raised from those mines alone every year. He would make a passing allusion to one remark of Mr. Hyde Clarke, who seemed to entertain some apprehension that the introduction of the rich copper ores of Australia and other countries would produce a sensible effect upon the working of the copper mines of England. He found the facts of the case to be, that, although there had been an increase in the importations of foreign copper, there had been a large decrease in the production of British copper, and that the increase in the importation of foreign copper ore was not proportionate to the decrease in the production of copper from the British mines. That, he considered was not owing to the circumstance of the richer foreign ores preventing the British miners from working their poorer ores, but the average richness of the British copper ores had decreased, and the fact was that the produce of the British copper mines had decreased in proportion to the extent of the importations of foreign copper. He was in hopes that several of the practical men whom he saw present would have favoured the meeting with the results of their own experience in those matters; but as a member of the Society, of some rather long standing, he hoped he should not be considered out of order if he proposed a vote of thanks to Mr. Hyde Clarke, for the manner in which he had brought this subject before the Society. It was now something like 15 years since he had the honour of becoming a member of this very useful, and, he might add, illustrious Society. He was quite aware that practical papers were not those which always attracted the greatest attention; yet, although they appeared to be composed of dry materials, if those who took an interest in them would study them in detail in the Society's *Journal*, their importance would be appreciated. Having alluded to this Society and the wide sphere which it now occupied, not only in this country, but, he might say, in its varied ramifications throughout the different quarters of the globe, there was one thing in which he thought, perhaps, they had been somewhat remiss—that was that they had not been sufficiently prominent in offering rewards for improvements in the process of copper smelting.

Mr. P. L. **Simmonds**, being called upon by the Chairman, stated that he found he could add very little to the exceedingly practical and useful paper submitted to the Society by Mr. Clarke. The subject was one which required careful study to master the mechanical and business details so elaborately given. Mr. Clarke, from his business connections, and his ready grasp and comprehension of any matter brought before him, had been able to furnish to the Society, and through the Society to practical men at home and abroad, a large amount of very useful and instructive information not always accessible to the public. Mr. Clarke had observed that the supply or production of copper, home and foreign, did not come within the scope of his inquiry, but it was desirable, perhaps, to form an idea of the comparative value of this important metal. From the private purchases of home and foreign copper it was difficult, as Mr. Hunt had observed, to form a correct estimate. But our imports of foreign ore and regulus had been increasing of late years; the imports last year having been 75,832 tons of ore, and 19,262 tons of regulus, besides 7,000 or 8,000 tons of old copper and other forms; the largest quantity arriving from Chile, 21,385 tons, the next from Cuba, 16,352 tons, and 13,000 from Spain, besides small quantities of a few thousand tons from other quarters. Upwards of 8,000 tons were received from our Australian possessions, and 3,382 from Southern Africa. Our exports of wrought copper now approximated in value to three million sterling, and had been steadily increasing. There was one feature of the subject which could not, perhaps, be well alluded to by Mr. Clarke, but had been previously adverted to by the first speaker, and that was the injurious influence of the copper smelting monopoly on the projects of improvement and extension of the trade. These close monopolies had been found highly injurious to the advance of various other trades, and were gradually being abolished, in accordance with the more liberal policy of the day. Why our metal trade should alone be cramped by these exclusive and arbitrary influences, when so sweeping a censure was levelled at great monopolising companies, he could not conceive. He, therefore, had hoped to hear some practical men, of whom there were so many present, speak to this point, and suggest plans or proposals to remedy this gigantic abuse, by which the copper miners of Cornwall had suffered so severely from the fluctuations of the trade—for within the last year copper had fallen £26 per ton. While the metal trades were all open trades, they were at the same time all monopolies, and it would be well to consider how the interests of our mines were affected and compromised by the unfair influences thus exercised, which retarded improvement, and naturally influenced prices.—Mr. Simmonds subsequently handed in to the Secretary the following statistics, as bearing upon the subject of the copper trade.

Exports of copper from South Australia:—

	Metal.	Ore.
1853	24,303 cwt.	3766½ cwt.
1854	8,119 ,,	3247½ ,,
1855	12,255 ,,	4039 ,,
1856	44,980 ,,	9468 ,,

Copper ore exported from Cuba:—

1851	432,882 cwt.
1852	381,470 ,,
1853	345,080 ,,
1854	549,553 ,,
1855	372,608 ,,

Exports of copper of all kinds in the last three years, with the declared value:—

	Quantity.	Value.
1855	17,498 tons	£2,110,916
1856	22,863 ,,	2,648,259
1857	25,241 ,,	2,855,831

Mr. **John Bethell** said he could testify to the fact that the copper monopoly in this country had been the means of retarding improvements in the smelting and manufacture of copper. A few years ago, a foreign gentleman came to this country with a view of introducing a process of smelting different to what was carried on here. He (Mr. Bethell) gave what assistance he could in carrying out the project, but the great difficulty they had to contend with was that they could not get a supply of ore. The monopoly of the English copper smelters was such that parties not connected with the Copper Smelters' Association of Cornwall and Devon could not procure a supply of ore; and although they might purchase foreign ores, they could not obtain English ores to mix with them, owing to the monopoly which prevailed in that trade.

The **Chairman** said, in the absence of any further observations on this subject, it was his pleasing duty to put to the meeting the proposition of Mr. Murchison, that they should return their best thanks to Mr. Hyde Clarke, for his very able and interesting paper. With the permission of the meeting, he (the chairman) would say a very few words upon the important subject which had been presented to them. They could, none of them, be insensible to the gigantic development that had taken place in the metal manufactures of this country, and no one could fail to see that this had been the growth of the last half century, although it had been less in copper than in iron; in both branches of manufacture, however, the advance had been enormous in a very short period of time. The industrial and economical interests involved in the production of copper could not be exaggerated. It was therefore of the utmost importance that practical information should be given in so useful a manner as it had been that evening upon the various processes whereby copper could be best manipulated, and whereby that extraordinary monopoly which had been alluded to might be, sooner or later, put an end to; for he felt, that when light was thrown upon a subject of such deep and pressing interest beneficial results must accrue. He recollected that the smelting of copper was introduced into Monmouthshire half-a-century ago, and works were erected at Risca, a few miles from Newport; but they were stopped, owing to the monopoly in the trade. At that time, in order to ensure the supply being below the demand, a ballot took place between the smelters as to which works should be closed, and the works to which he alluded were those upon which the lot fell, and from that time to the present those works, which were most fortunately situated in the centre of the coal fields, had stopped all operations. It was obvious that if they brought to bear improved manipulation, and improved chemical and mechanical processes, in the conversion of ore into metal, they necessarily limited the power of monopoly by decreasing the amount of capital required to be employed in carrying on those operations, and to that extent they increased the ability to compete with those who at present held the field against the public. Although he was not practically acquainted with this subject, he was, nevertheless, fully alive to the commercial and industrial importance of the question before them. He trusted that this paper, and the discussion which had followed it, would lead to further inquiry. In conclusion, he would put to the meeting the resolution proposed by Mr. Murchison, which otherwise he would himself have brought forward, namely, a cordial vote of thanks to Mr. Hyde Clarke for his paper.

A vote of thanks was then passed to Mr. Hyde Clarke, who, in acknowledging the compliment, said that in bringing forward a subject of a practical nature, the author of it had necessarily to run the gauntlet of criticism. On the present occasion they were favoured with the attendance of gentlemen who were not simply connected with the trade, *but* who had many of them introduced considerable improvements and exercised an important influence upon *it*, so that the test had been a severe one. With regard to what had fallen from Mr. Low, he (Mr. Hyde Clarke) could confirm his statement as to the general principles involved in the process he had described, which he could testify had been carried out with great success in other cases; this confirmed the principle laid down by him, that copper ore could be reduced in a shorter space of time than by the methods ordinarily employed, by the addition of carbonaceous flux, although it was considered by some to deteriorate the quality of the copper. He had, however, seen specimens produced by Mr. Low's process, which were as good as could be desired. The Chairman had called attention to the growth of the metal trade in this country. That was a branch of the subject into which it was not his province to enter that evening. The growth of that interest was the result of unrestricted competition, and the stationary condition of the one branch which had been then under discussion was, in his opinion, to be attributed to the monopoly that existed in it. So far as the treatment of ores was concerned, they were nearly all subjects of monopoly in this country. No one knew better than Mr. Murchison the difficulties that had to be contended with in the metal markets, and these difficulties applied to ores other than copper. They existed with regard to tin, spelter, lead, and silver, and also the less important metals, nickel and cobalt, all of which were held by three or four influential houses; and large portions of copper ore containing gold and silver were lost to commerce from this state of the trade. With regard to Bristol, he had no intention to depreciate the importance of the smelting works there; but in the present state of the trade there was no doubt they were of less importance than the enormous works in South Wales. Mr. Phillips had misunderstood him as to the future of copper mining in this country. That gentleman had brought forward some valuable remarks as to the average per centage of the copper ores of England. So far from thinking this a proof of decline, they must regard it as a proof of the improvement which had taken place both in the mining and manufacturing operations; that instead of being restricted to the working of ores yielding 20 per cent. of copper, as was the case in some other countries, they could bring ores of much lower figure into the market with a profit even, as had been stated by Mr. Phillips, as low as three-quarter per cent of metal, for they could now be profitably reduced.

The Paper was illustrated with specimens lent by Dr. Percy, Government School of Mines; Mr. Gilbertson, Managing Assistant of the Corporation of the Governor and Company of the Copper Miners of England, illustrating the whole process of smelting; Mr. E. J. Cole, a like collection from the Alten Works; Mr. W. Rowley, malachite and peacock ore; Mr. T. Hancock, Secretary to the Rhine Copper Company, specimens of ore, some of 70 to 80 per cent.; Messrs. Phillips and Darlington, Lake Superior Copper; Professor Tennant, muriate of copper from Chile; pure copper with native silver from Lake Superior; native silver with native copper from the same place; and remarkable specimens from Cornwall and South Australia; and with drawings on a large scale by Mr. Hyde Clarke.

The Secretary announced that, on Wednesday evening next, the 8th of December, a Paper, by Mr. P. A. Halkett, "On Guideway Agriculture; being a System enabling all the Operations of the Farm to be performed by Steam Power," would be read. On this evening W. Fothergill Cooke, Esq., will preside.

THE ROYAL SOCIETY.

The anniversary meeting of the Royal Society was held on the 30th November, at Burlington-house, on which occasion Lord Wrottesley delivered his annual address, reviewing the progress of science during the past year. The medals were then awarded as follows:—The Copley Medal, to Sir Charles Lyell, for his various researches and writings, by which he has contributed to the advancement of geology; a Royal Medal to Mr. Albany Hancock, for his various researches on the anatomy of the mollusca; and the Second Royal Medal to Mr. William Lassell, for his various astronomical discoveries and researches; and the Rumford Medal to Professor Jamin, of Paris, for his various experimental researches on light. The election of new council and council then took place. Sir Benjamin Brodie, Bart., was elected president.

ON THE ELASTIC FORCE OF THE GASEOUS PRODUCTS OF COMBUSTION.

By Henry Maxwell Lefroy (West Australia).

The fact that the elastic force which belongs to the caloric contained in 1lb. of good coal is equal to the raising a weight of not less than 6,000,000lbs. through a space of one foot perpendicularly to the horizon, has been established by the investigations of Sir H. de la Beche, of Mr. Joule, and other physicists; nevertheless 1,000,000 lbs. raised one foot high for every lb. of fuel consumed, is the greatest duty actually obtained in the best steam engines hitherto constructed.

Such a vast disproportion between the amount of mechanical force theoretically due to the quantity of fuel consumed and that which is actually obtained in the best engines, certainly appears to indicate that some radical defect is yet retained in the organic constitution of this invaluable auxiliary of human industry, notwithstanding the practical perfection to which (abstracting such supposed organic defect) the unceasing labour during more than the past hundred years, of tens of thousands of the most skilful mechanics and of many hundreds of the votaries of pure physical science, must undoubtedly have brought it.

Although unknown as a skilful mechanic or votary of physical science, yet, having reflected much on this subject since 1853, when I first printed a short paper upon it, I beg to suggest the possibility, nay, the great probability that this hitherto ignored organic defect consists entirely in the rejection or non-use of the elastic force of the gases into which the fuel is decomposed by combustion and of all that portion of the caloric developed by that combustion which the time occupied in the transmission of the gases through the tubes of the boiler does not permit to pass through the material of those tubes into the water, and which must consequently be discharged into the atmosphere, partly latent, partly sensible in combination with those gases.

If this supposition be correct, the great desideratum will appear to be such a construction of the boiler and furnaces of the steam engine as will permit the whole of the gases into which the fuel is decomposed by combustion, together with the whole of the caloric developed by this combustion, to pass bodily out of the furnace into the water, and through this latter into the power cylinders; and to effect this is the peculiar object of the boiler and furnaces represented in the engraving.

The *à priori* improbability that more than a very small fraction of the total caloric developed in the furnace of a steam engine as at present constructed, can be transmitted through the metal plates of the boiler into the water within, must, I think, be evident to any person who carefully considers the molecular constitution of a plate of metal, and what is known of the physical nature of heat; and so far the recondite deductions of the physical philosopher, as to one of the most inscrutable of physical phenomena, accord well with the conceptions of sound common sense.

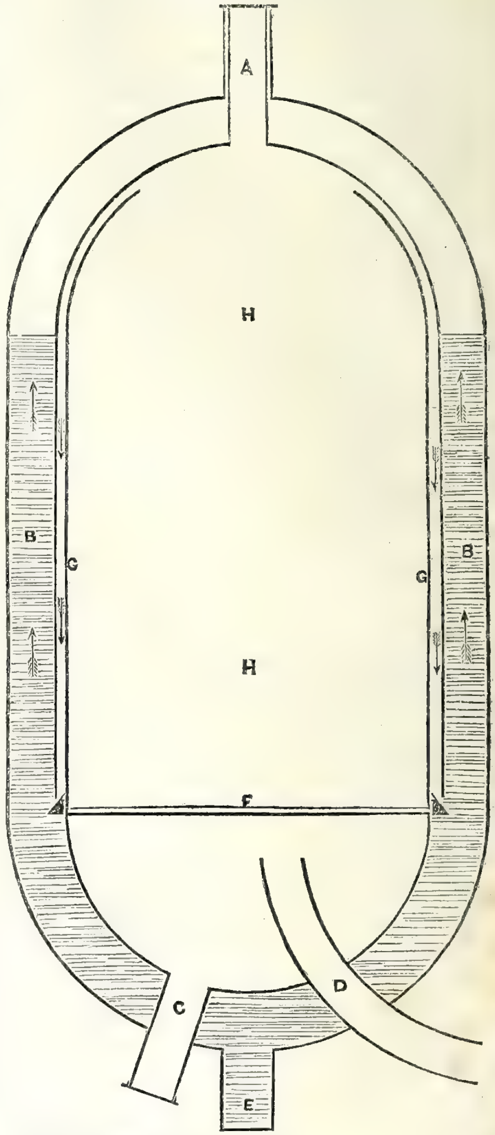
The ingenuity of engine makers has long been exerted in the endeavour to increase the ratio of the portion of boiler surface directly acted on by the fire to the volume of the boiler and the quantity of the fuel consumed; but I am not aware that a suggestion to save the whole of the caloric, which in the present construction of the steam engine necessarily is drafted through the chimney into the atmosphere, by forcing bodily into the water the whole of the gaseous products of the combustion of the fuel, has ever before been made.

An excess of pressure in the surface over that in the boiler being the means proposed to be employed for forcing the products of combustion out of the furnace into the boiler, which, it will be seen by reference to the engraving, entirely encloses it, air must be forced on to the surface by artificial means, and the combustion take place under a pressure exceeding that of the atmosphere.

I believe it will be admitted, by all who have sufficiently studied this branch of physical science, that the elastic force or quantity of caloric developed by the combustion of a given quantity of fuel, is not constant for all atmospheric pressures under which combustion can take place, but varies with some function (not exactly known, but probably, for *practicable pressures*, not differing much from the third root of its second power) of the pressure, whence a further great economy of fuel may be expected to result from the simple fact that its combustion, in the construction proposed, will take place under a high pressure, probably that of 10 to 15 atmospheres.

It must be borne in mind that the whole of the mechanical force expended in condensing the air supplied to support the combustion in the proposed form of engine, less the part consumed in overcoming the friction and *vis inertia* of the machinery employed in the operation (the whole of such condensed air passing either in an altered or unaltered state into the power cylinders) is really returned to the engine in those cylinders, and therefore it would be erroneous to consider the mechanical force so expended as a deduction from the net effective power of the engine.

A VERTICAL AND DIAMETRAL SECTION OF THE PROPOSED BOILER AND FURNACE.



A. Pipe for supply of fuel to furnace.
B. Boiler.
C. Pipe for discharge of ashes from the furnace.
D. Pipe to supply condensed air to the furnace.
E. Pipe for discharge of lime and other impurities from boiler.
F. Fire bar.
G. Cylindrical shell for the passage of the products of combustion.
H. Furnace.

Therefore, the advantages attributable to the proposed construction of the furnaces and boilers of steam-engines may be stated as follows:—

1st. The development of an absolutely larger quantity of elastic force, by conducting the combustion under a pressure of several atmospheres, than will be developed when the combustion takes place in the open air.

2nd. The conservation and utilization of the whole of the caloric actually developed, by so conducting the combustion as to pass the entire products of combustion, whether ponderable or imponderable, bodily into the water, and through the water into the power cylinders, whereas, under the existing system, the entire of the ponderable, and probably five-sixths of the imponderable products of combustion are discharged through the funnel into the atmosphere.

3rd. The diminished volume referably to power generated and consequent economy of space (so important on board of ships), of prime cost, and of subsequent wear and tear of both boilers and furnaces. A further economy will result from no part whatever of the boiler surface being exposed to the direct action of the fire, or to a destructive temperature, whilst the furnace, which alone is subjected to a very high temperature, is not subjected to any distending pressure, or rather the pressure in the furnace will exceed that in the enveloping boiler, only by that small quantity, say 1lb. to the inch, which may correspond to the most convenient velocity of motion of the gaseous products of combustion out of the former into the latter. This diminished volume, weight, and cost of the steam engine will be attended with peculiar and especial advantages in railway locomotion, and in the application of the steam engine to innumerable purposes, both of rural and urban industry, of the economy of which the easy portability of the engine is the most essential condition.

4th. The less exposure of all classes employed in the furnace and engine rooms to the injurious effects of intense heat.

5th. The entire supersession of the funnel or chimney.

Probably an experienced engine maker will readily discern other practical advantages of a minor value in the proposed form of this apparatus, if he shall be sufficiently pleased with the general conception to give it that attentive consideration which the importance of the object sought, if not any intrinsic merit or novelty in the method proposed, will justify.

In the accompanying engraving every part not essentially necessary to the exposition of the specific ideas of placing the furnace near the axis of the boiler, of discharging bodily into the water, and subsequently employing, as elastic bodies in the power of cylinders, the whole gaseous products of the combustion of the fuel; of conducting that combustion under a pressure of several atmospheres, has been intentionally omitted, from a conviction that any experienced engine-maker will readily supply such parts for himself if he shall be satisfied with the general soundness of the form of construction which I propose, and of my inferences of immense economical advantages due to it.

If, as I anticipate, experience shall demonstrate the economy of conducting the combustion under a very high pressure, say 200 or 300lbs. to the inch, it will be necessary to provide for closing the communication between the furnace and the boiler on each occasion of stoking, in order to save that loss of caloric which would be involved in the reduction of the pressure in the boiler from the high rate above supposed, to that of the external atmosphere. For this purpose a simple annular float, of a specific gravity slightly less than that of boiling water, embracing the furnace immediately below the bottom of the inverted dome-shaped furnace cover, and which would consequently be thrust into the bottom of the annular space between the furnace and the said cover, whenever the pressure in the furnace was reduced below that in the boiler (as it must be on each occasion of stoking), would suffice; and as the loss of elastic force incurred by opening the communication of the furnace with the external air would thus be limited to the measure of the quantity of condensed air actually in the furnace at the instant of opening the stoke pipe (the communication of the furnace with the condensed air chest having previously been cut off), I think it would be unnecessary to introduce an apparatus to supply the fuel without permitting the reduction of the pressure in the furnace; but if the latter object were very desirable, it could be effected without material difficulty.

I anticipate that in practice, a supply of fuel once in every hour will be found sufficient, and by suspending in a conical-shaped box immediately over the stoke pipe, prior to the removal of the cap from its top, the charge of fuel to be obtained, probably less than two minutes would elapse between the instant of unclosing and that of re-closing the said air-tight fitting cap after discharge of the fuel into the furnace, during which a greater or less diminution, but by no means a suspension of the development of elastic force, far superior to the current expenditure of two or three minutes' work of the engine, would always exist in the excess of the temperature of the water actually used, over that of water boiling under the pressure of the external atmosphere, but for marine, and probably other purposes, it may be found convenient to keep two distinct sets of boilers and furnaces in operation to supply one system of engines.

It has been suggested by some practical engineers who have examined my proposals, that under the high temperature and pressure at which it is proposed to conduct the combustion, a large amount of clinkers will be formed from the melting of the fuel, but a careful consideration of the subject has relieved me from much apprehension of such a result. On the contrary, I anticipate that a more perfect combustion than ever takes place under simple atmospheric pressure, will be found to result from the high pressure proposed to be employed, and consequently that the unconsumed residuum of the fuel exposed to such combustion will be confined to the most purely mineral and therefore incombustible matter.

Other engineers have suggested that the gases will carry with them, through the water into the power cylinders, such a quantity of the ashes of the fuel as will be very destructive to the polished surfaces of the different parts of the engine which may be reached by them; but when it is considered that the whole of such ashes as may be carried over the sides of the furnace will enter the water with a *descending motion*, that subsequently the bubbles of air in which it may be apprehended that they will be carried up through the water into the power cylinders, may be broken to any extent required by passing through any number of thin plates of metal, perforated with fine holes, which may be fixed in the water one over the other, I think there is little reason to apprehend that any mineral or gritty matter of *sensible volume* will ever be carried into the engine; on the contrary, I calculate that it will be quietly deposited on the bottom of the boiler by a continuation of the descending motion with which it will enter it, whence it can be discharged through the dirt pipe. This is essentially a smoke-consuming engine, of the most simple and effectual character.

The time may not be distant when, the apartments of our private residences being heated by small apparatus of this form of construction, whose volume will be measured by a few cubic inches, and daily consumption of fuel by ounces instead of by pounds, and power to give motion to the machinery of the numberless factories of our industry being generated by a smokeless and complete combustion of the fossil fuel, which was laid by for human use, in quantities inexhaustible, countless ages before the Omniscient Deity breathed the breath of life into the nostrils of the common parent of our race, the lurid clouds of unconsumed fuel which now pollute and oppress the atmosphere of our large cities, and poison the health of the millions of air-breathing men who toil therein, may pass from the catagory of the necessary physical conditions of urban life, into the pages of the historian of the progress of human society.

The following note was appended to a pamphlet published by Mr. Alexander Gordon, C.E., "On the Power of Heat for Propelling of Ships, and the Duty of a Cubic Foot of Coal. 1852:"—

> An investigation of the volume, under normal atmospheric conditions, which will be assumed by the products of combustion of 1℔ Jones' Anthracite Coal, and of the nitrogen which will be liberated from the oxygen in the atmospheric air required to support the combustion, by Mr. H. M. Lefroy, R.N. April, 1851.

The constituents of 1℔ of this coal, as stated in Sir H. De la Beche's Report on Steam Coal, are:—

Carbon	0·9144 ℔s.	=1℔.
Hydrogen	0·0344	
Nitrogen	0·0021	
Sulphur.....................	0·0079	
Oxygen......................	0·0258	
Ash	0·0152	

1 part of carbon combining with 2·66 parts of oxygen, the carbon above given will be converted into $0{\cdot}9144 = (1+2{\cdot}66) = 3{\cdot}346$℔s carbonic acid.

1 part hydrogen combining with 8 parts of oxygen, the hydrogen above given will be converted into $0{\cdot}0444\ (1+8) = 0{\cdot}3114$℔s aqueous vapour.

21 parts of oxygen combining with 78 parts of nitrogen in atmospheric air, the nitrogen combined with the oxygen required to sustain the combustion of the carbon will be $0{\cdot}9144\times2{\cdot}66\times\frac{78}{21}=9{\cdot}055$℔s.

Similarly the nitrogen in combination with the oxygen required to sustain the combustion of the hydrogen will be $0{\cdot}0346\times8\times\frac{78}{21}=1{\cdot}029$℔s.

Therefore the total nitrogen contained in the closed furnace will be $0{\cdot}0021+9{\cdot}055+1{\cdot}029=10{\cdot}146$℔s.

13268 units of caloric are developed by the combustion of 1 part of carbon.

62470 units of caloric are developed by the combustion of 1 part of hydrogen.

Therefore the HEAT DEVELOPED by the conversion of the above given quantities of carbon and hydrogen into carbonic acid and steam respectively will be $0{\cdot}9144\times13268+0{\cdot}0346\times62470=14092$ units of caloric.

NOTE.—By unit of caloric is meant, throughout this investigation, that quantity which will raise the temperature of 1℔ of water 1° Fahrenheit scale.

Under normal conditions—

The specific heat of water is.....................	0·8470
,, ,, nitrogen	0·2754
,, ,, carbonic acid..............	0·2210
The coefficient of dilatation of water	0·003179
,, ,, ,, nitrogen......	0·003719
,, ,, ,, carbonic acid	0·003719
The volume of 1℔ of water (steam)	28·97 cubic ft
,, ,, nitrogen	13·1 ,,
,, ,, carbonic acid	8·36 ,,

MEETINGS FOR THE ENSUING WEEK.

MON.......London Institution, 7. Prof. Tyndall, "On Light."
TUES. ...Civil Engineers, 8. Mr. M. Scott, "Description of a Breakwater at the Port of Blyth."
Pharmaceutical, 8.
Pathological, 8.
WED. ...London Institution, 3. Mr. T. R. Jones, "On the Natural History of the Vertebrate-Division of the Animal Kingdom."
Society of Arts, 8. Mr. P. A. Halkett, "On Guideway Agriculture."
THURS....London Institution, 7. Dr. E. Frankland, "On the Air and Water of Towns."

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 26, 1858.]

Dated 31*st July*, 1858.

1740. C. de Bergue, Dowgate-hill, London—Imp. in submarine telegraphic cables, and in machinery for paying out or laying down the same.

Dated 2*nd November*, 1858.

2437. L. Beaver, Manchester, Lancashire—An imp. in sleeve-links.

2439. M. A. F. Mennons, Rue de l'Echiquier, Paris—An improved combination for the production of voltaic electricity, and its application as a curative agent to certain parts of the human body. (A com.)

2441. N. Brough, Birmingham—Certain imp. in buttons, and in the means of attaching them to garments, which said means is also applicable for other purposes.

2452. J. Lancaster, Belfast, Antrim—A new or improved method of driving and curbing horses.

2445. A. Barclay, Kilmarnock, Ayr, N.B.—Certain imp. in electric and magnetic, or electro-magnetic telegraphs, applicable to submarine and land communication.

2447. J. Sampson, J. Machon, and J. Bartholomew, Sheffield—Imp. in railway carriage brakes.

2449. N. S. Dodge, St. Paul's-churchyard—Imp. in treating waste vulcanised india-rubber. (A com.)

Dated 3*rd November*, 1858.

2451. C. F. O. Glassford, Greenwich—Imp. in the manufacture of manure from the excreta of towns.

2455. V. Blumberg, Bloomfield-lodge, Notting-hill—Imp. in the construction of slate billiard-tables, which improvements are also applicable for other useful purposes.

2455. D. Fryer, T. L. C. Watt, and W. Holmes, Paternoster-row, —Imp. in tanning hides and skins.

2457. P. A. Mawdsley, Seacombe, Cheshire—The use or application of a certain substance or substances in the manufacture, stiffening, or sizing of paper.

2459. F. B. Busse, Carlton-terrace, Sydenham-park, Kent—Imp. in breech-loading fire-arms. (A com.)

Dated 4*th November*, 1858.

2461. J. Oxley, Camden-town—Imp. in carriages and wheel vehicles.

2463. G. A. Evelyn, Eccleston-terrace—The imp. of the form of the stocks of rifles, carabines, and other fire-arms.

2465. C. Mather, Salford, Lancashire—Imp. in drying yarns while in the hank.

2467. R. A. Brooman, Fleet-street, London—Imp. in treating air and gases, and the employment of the same for obtaining motive power. (A com.)

2469. A. Friedmann, Frankfort-on-the-Maine—An imp. in bracelets, necklets, and rings.

Dated 5*th November*, 1858.

2471. T. Till, Hooper-street, Birmingham—Imp. in machinery for making nails, and for other analogous purposes where metal is compressed by dies or stamps.

2473. C. J. Tjador, Stockholm, Sweden—Imp. in gun carriages, and in apparatus for lessening recoil.

2475. D. McClure, Heaton Norris, Lancashire—An imp. in the machinery used for the drying of yarn, thread, cloth, or other wet fabrics.

2477. L. Schwartzkorf and F. C. Phillipson, Berlin—Imp. in machinery for boring holes in rocks and minerals, for blasting and other similar purposes.

2479. R. E. Pinhey, Woolstan, and J. Wood, High-street, Southampton—Imp. in apparatus for ascertaining the variation of ship's compasses for local errors.

Dated 6*th November*, 1858.

2481. H. N. Penrice, Witton-house, near Norwich—Imp. in machinery for tunnelling and driving galleries through rock and other strata.

2483. B. W. Jonas and R. Jones, Southwark, Surrey—An improved ship's block.

2485. J. Cliff, Lambeth, Surrey—Imp. in the construction of kilns for burning stoneware, red clay-ware, porcelain, and all other kinds of earthenware.

2487. W. Ziernogel, Hettstadt, near Eisleben, Prussia—Imps. in apparatus for distilling products from bituminous coal, schist, peat, and other like substances.

2489. J. Jackson, A. Fisher, and J. J. Harney, Sheffield—Imp. in the manufacture of strips or bands of steel, and in the machinery or apparatus to be employed therein.

Dated 8*th November*, 1858.

2491. J. Richmond, Carlisle-terrace, Fairfield-road, Bow, J. Quick, jun., and A. Frazer, Summer-street, Southwark—Construction of a meter for measuring water, spirits, or any other fluids.

2493. E. Alcan, Coleman-street-buildings, London—An improved method of treating or preparing materials to be manufactured into paper, applicable to lye-washings in general. (A com.)

2495. J. Wardill, Commercial-road, East—Imp. in purchases for the raising and lowering of weights by means of chains, especially applicable to ships' capstans and windlasses.

Journal of the Society of Arts.

FRIDAY, DECEMBER 10, 1858.

SOCIETY OF ARTS EXAMINATIONS.

The Council have much pleasure in announcing that Mr. George Harrison, of the Young Mens' Christian Institute, Leeds, and Mr. George Best, of the Mechanics' Institution, Leeds, who distinguished themselves at the Society's Examinations in May last, and who had been nominated by the Council to compete for Supernumerary Surveyorships of Taxes, have obtained appointments, being placed first and second respectively in the list of successful candidates.

There were on this occasion five vacancies and fifteen selected candidates, two nominations having been placed at the disposal of the Council by Lord Derby.

The following letter has been received from the Secretary to the Treasury:—

Treasury, S.W., 7th December, 1858.

Sir,—I find, from a report I have this day received from the Civil Service Commissioners, that Mr. George Harrison and Mr. George Best, have succeeded in obtaining the first and second places respectively in the late competition; and I have had much pleasure in giving directions for their appointment as Supernumerary Surveyors of Taxes accordingly.

I have the honour to be, Sir,
Your obedient servant,
(Signed) W. J. HYLTON JOLLIFFE.

P. Le Neve Foster, Esq.

FOURTH ORDINARY MEETING.

Wednesday, Dec. 8, 1858.

The Fourth Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 8th inst., Thomas Dyke Acland, Esq., Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Chance, George
Terry, Alex. Robt., C.E.

The Paper read was—

ON GUIDEWAY AGRICULTURE: BEING A SYSTEM ENABLING ALL THE OPERATIONS OF THE FARM TO BE PERFORMED BY STEAM-POWER.

By P. A. Halkett.

In bringing the subject for this evening, "Guideway Steam Agriculture," before the members of this distinguished Society, I feel that it is incumbent upon me to give as full a description of the plan and machinery as possible, but as the details are numerous, and I shall not, in the space of time allotted to me by your kindness, be able to enter into an explanation of all its parts, I hope that I may be permitted to refer members desirous of further examination of the subject to that which was published last year, namely, a letter to the Secretary of the Royal Agricultural Society, which appeared in your Society's Journal, to the published accounts of the system in the professional papers and to the reports of a meeting at Freemason's Tavern; since which time, however, some very important improvements have been invented, and amongst others, a new system of guideways by which the cost per acre may be considerably reduced, and a new cultivator suitable to small holdings.

My invention, comprising a system of permanent way which is fixed to the ground, renders me unable to exhibit for competition at the annual shows of the Royal and other Agricultural Societies, and the amount of publicity which it would in consequence obtain, is lost; but I may truly say, that notwithstanding this, there is a fast growing opinion that the system which I bring before you this evening is the one which, in all respects, best fulfils the wants and expectations of the agricultural community upon the subject of steam cultivation.

The great advances which have been made by Messrs. Smith, Fowler, Romaine, Boydell and others, in ploughing and breaking up the land within the last year or two, have schooled the mind to the possibility of steam being eligible for use in the field, and prepared the agriculturalist to expect a system that shall perform more than one operation.

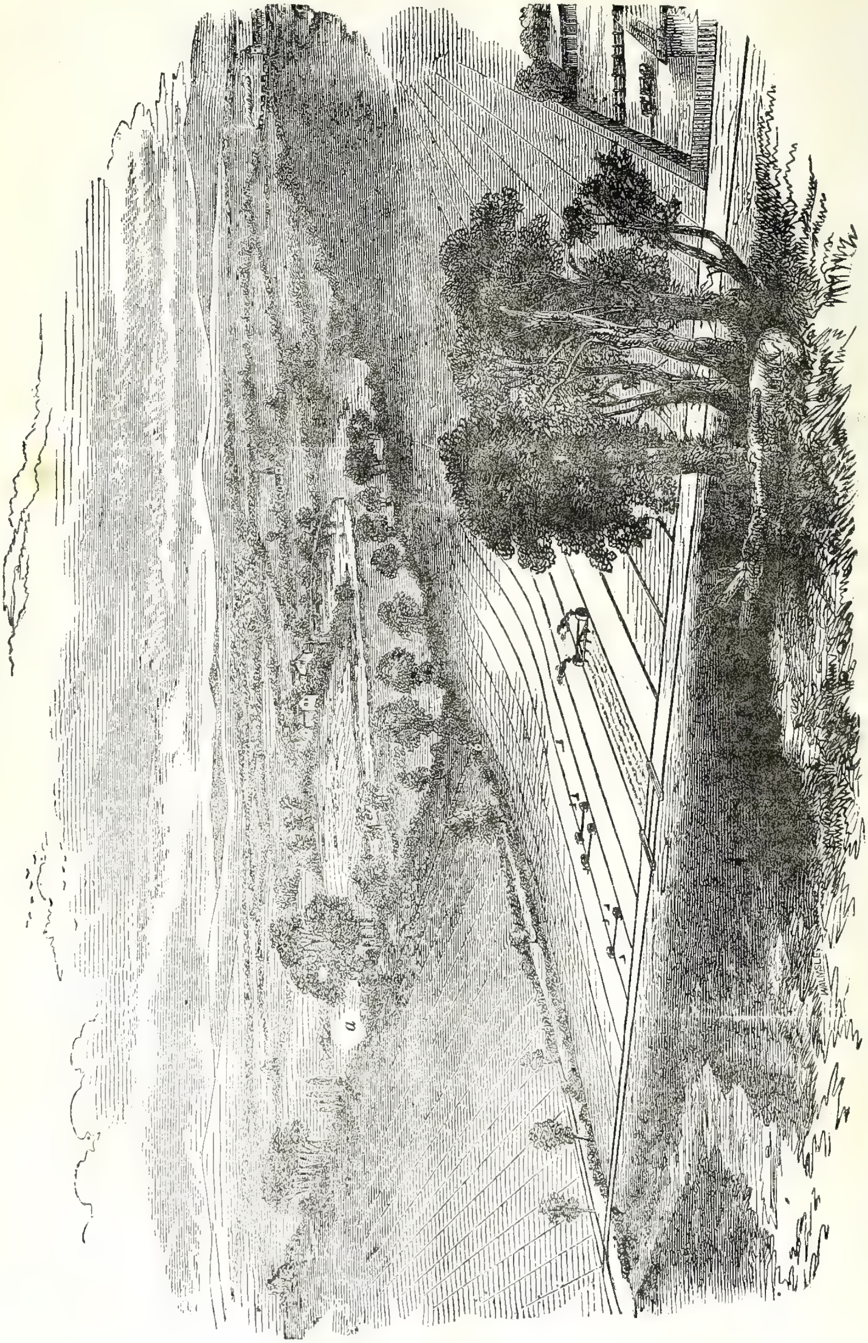
Another important change has taken place in the mind of the public, relative to the source from which the profits are to be looked for in steam cultivation; this arises from the belief that the commercial advantages gained by Mr. Smith and Mr. Fowler are not so much in the less cost of the operations themselves as in the increase of crops resulting from those operations, and in some collateral economic advantages to which I will refer again; but it is this better cultivation and consequent larger amount of produce which is the most important consideration to hold in view, and the point in which I maintain that my system has its greatest strength; and I may say, without fear of contradiction, that there has not been a competent judge, who has seen my operations, who has not given it as his opinion that much larger returns will be obtained by my system. Let us for one moment look at the question of profit by means of produce, and profit by saving on labour and it will be seen in which direction the most is to be expected; in the one case let us suppose produce to be increased, merely for illustration, 50 per cent., or from, say, £8 to £12, and in the other let us suppose the cost of field labour to be £3, and to be decreased in the same proportion, namely, to £2; in the one case a profit will be made of £4, and in the other of £1.

Present produce £8, increased to £12. Profit £4.
Present labour £3, reduced to £2. Profit £1.

There are three ways in which we may expect that steam may prove beneficial to us—first by a saving upon labour. It is in this direction that the endeavours of most inventors have been turned, and it is for that only that the Royal Agricultural Society has held out its premiums to inventors. In their prize sheets the wording ran thus:—"For the best steam cultivator that shall turn over the soil and be an economic substitute for the plough and the spade." The second way is by an increase in the produce—and the third both advantages combined. My system is conceived in the last, but its forte lies especially in a much better cultivation with a view to a larger amount of produce.

I will now, as shortly as I can, describe the system and the large machinery applicable to extensive holdings, and from which, as in the case of the manufactory, producing goods at a considerably cheaper rate than the cottage loom, we may expect the most important commercial advantages. I will then describe the smaller cultivator, on a perfectly different construction, and for which I have very much to thank the engineer, Mr. Grafton. Although it will not carry out the operations at so small a cost as the large cultivator, yet, by its being applicable to small holdings, it will enable land to be laid down with this system which before could not be thought suitable for it; and I will, when describing the prominent subject of the invention, the guide-ways or rails, invite your attention to a system of rails which was not brought before the public last year, and which will reduce the cost of the system by one-half per acre what it then was calculated at.

Fig. 1.



View of a Farm laid down with Guideways, showing the Cultivator ploughing; a number of trucks taking off produce; the headland rails upon which the Cultivator is moved from one set of rails, or from one part of the farm to another, and a level crossing at the road, to enable it to communicate with the adjoining fields.

The diagram (Fig. 1) will convey some idea of the Guide-way system of steam agriculture. This invention consists in the application of motive power to the cultivation of the land, by attaching the implements required for the various operations of ploughing, scarifying, sowing, hoeing, reaping, or other operations of culture, beneath a travelling carriage, which moves on rails placed in parallel lines across the fields to be cultivated, by which the implements are always kept from swerving to the right or left of the line of onward motion, and the friction of the machinery is considerably reduced.

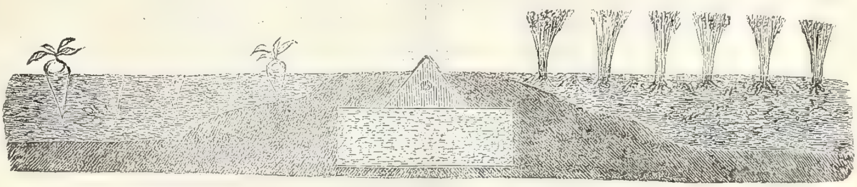
The gauge or space between the lines should be as wide as possible, consistent with the practical application of the travelling carriage or cultivator, in order to diminish the cost of rails by reducing the number per acre as also the extent of space occupied by the permanent way. The width between the lines I have in use upon my land at Wandsworth, or upon the piece of ground at Canning-place, Kensington toll-gate, is thirty feet, but there can be no difficulty in extending it to fifty or more feet.

At right angles to those rails along the headlands, separate railways are made on a lower level than the former rails, and upon each headland railway a carriage is placed, the top surface of which is on a level with the field rails, and upon this the cultivating machinery moves, and is transferred sideways from one set of rails to another, or home to the steading, where it may be used for barn operations; supposing, then, the ground between the two first rails to have been operated upon, the machine is propelled on to the headland carriage, and by it transferred or shunted in the manner that carriages are shunted on railroads, to the next breadth of rails down which the cultivator proceeds, and so on until it has passed over all the land to be cultivated.

The methods I have adopted for laying down the rails, varying in materials, &c., according to circumstances, are as follows:—

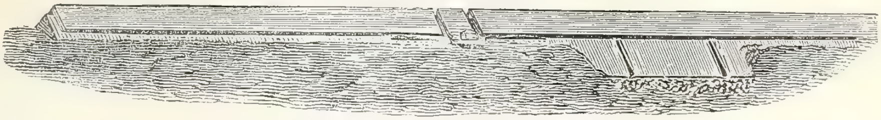
A hard burned brick with angle iron rail (Fig. 2).

Fig. 2.



A trench is cut fifteen inches at the top down to the subsoil. This is filled with burnt clay ballast or concrete, and on this are laid the angular shaped bricks, and the earth is then covered over nearly to the top of the rail. Angle irons, 17 or 20 feet in length, are laid on the top of the bricks. These are fixed down at the ends by strap pieces, as shown in fig. 3, and secured by bolts to bricks in the subsoil. The angle irons are not secured to each other so as to form one continuous length, but are left unconnected at certain distances, in such a manner as to allow for the expansion and contraction resulting from the temperature.

Fig. 3.



To test the rails, I worked the cultivator backwards and forwards over a portion of them thus constructed, as often as would have been necessary in cultivating a piece of land for 10 years, and no movement or alteration of the materials took place, nor had any part to be repaired. Occasionally, when the machine travels over the ground, a brush is made, by self-acting means, to deposit a coat of tar over the surface of the rails, thus giving effectually at a small cost a preservative coat to the iron.

In this system of rails, well adapted for clay districts, the materials being very durable, the per centage for renewals will be very small. In fact, the system may be considered of an almost indestructible character.

The surface of the iron rail being angular, the tires of the wheels of the cultivator have angular grooves, into which the rail fits.

Fig. 4.

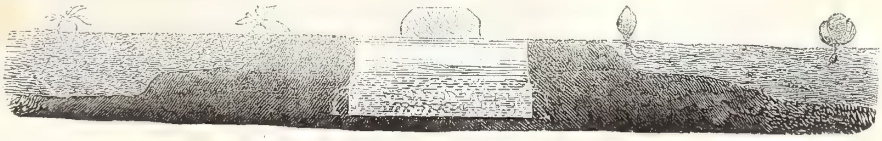


Fig. 4 shows the new system to which I alluded, namely, a flat surfaced wooden rail.

A trench is cut and filled with ballast, as before described; upon this are placed sleepers, 12 or 14 inches long, and formed of pieces of branch-wood, called "lop and top," cut up and split. Upon these are fixed the rails, which are constructed of creosoted timber. This system is well adapted for a wood district, and may be cheaply laid down.

When land is very highly rented, as in market gardens, the rails being placed upon posts or small piles of wood, driven two or three feet into the ground and subsoil, a less loss of land occurs than in the other system, for the land may be deeply cultivated close to the rails; but this arrangement is more expensive than either of those just described.

The space taken up by the rails is of necessity so much taken off from the cultivable soil of the farm. This, however, is comparatively insignificant in amount, for, taking the foundation of the rails at two feet and a half, it is only the one-twentieth of the land, a loss of about two shillings per acre, taking the rent, &c., of the land at 40s. But, after all, the space of land lost is much less than in ordinary cases, with the open furrows between stetches, besides which, no farm roads are wanted, as everything required is taken on to, or off from the farm, by the agency of the guideway machinery.

It may at first be supposed that a practical difficulty lies in the maintenance of the permanent way from analogy with existing rails, and the keeping intact the width of the gauge; but it will be seen that there is a vast difference between the speed of the railway locomotive and that of my cultivator, the one travelling at a speed of 40 or 50 miles an hour, while the other travels at only 2 or 3 miles. Upon railroads the carriages and engines travel over the same ground in a year many thousand times, while in my system the carriages pass over the same spot in a year but 10 or 20 times. To allow for any slight variation in the breadth or gauge between the rails, running wheels are fitted on one side of the platform, so that they have sufficient play from side to side between the bearings, while those wheels on the other side of the cultivator have no similar play.

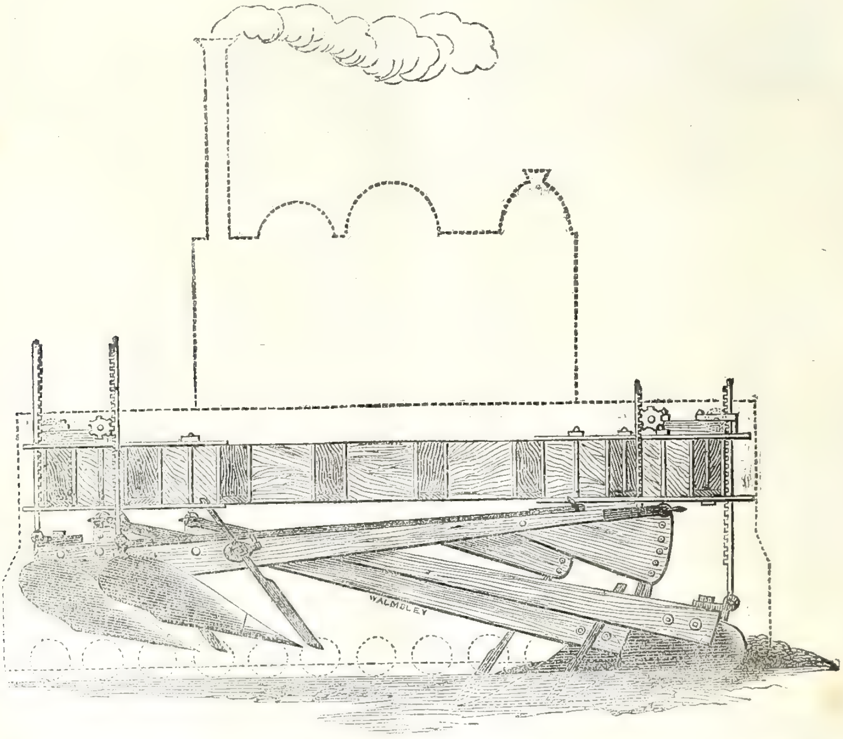
The bearings of the wheels are fitted to slide freely up and down, resistance to their moving upwards being offered by springs.

These springs are all of equal strength, and the machinery is so balanced that each wheel may bear as nearly as possible the same amount of weight, and the springs possess a considerable amount of elasticity, to permit the several wheels to pass over any undulation of the rails without transferring too much weight from some of the wheels to others of the series. The object in distributing the weight of the platform over a number of wheels is that the rails or permanent way may be of very much lighter construction than if the weight were made to rest on a less number of wheels.

The cultivator is driven by two engines, placed at the extreme ends or sides, which are geared together by an intermediate shaft, the ends being connected to the ends of the platform in such a manner that the whole set, 16 in number, act simultaneously as driving wheels. By being thus constructed, the machinery can ascend rising ground without difficulty, till the gradient reaches the point when iron slips upon iron, which is found to be one in five.

The diagram board before you represents a front elevation of the large cultivator.

Fig. 5.



Section of Steam Cultivator, showing one set of Ploughs in the Ground, and the opposite set raised and supported by the Racks and Pinions.

Fig. 5 is a transverse vertical section of the cultivator, showing the one set of ploughs in the ground and the opposite set raised and supported by racks and pinions.

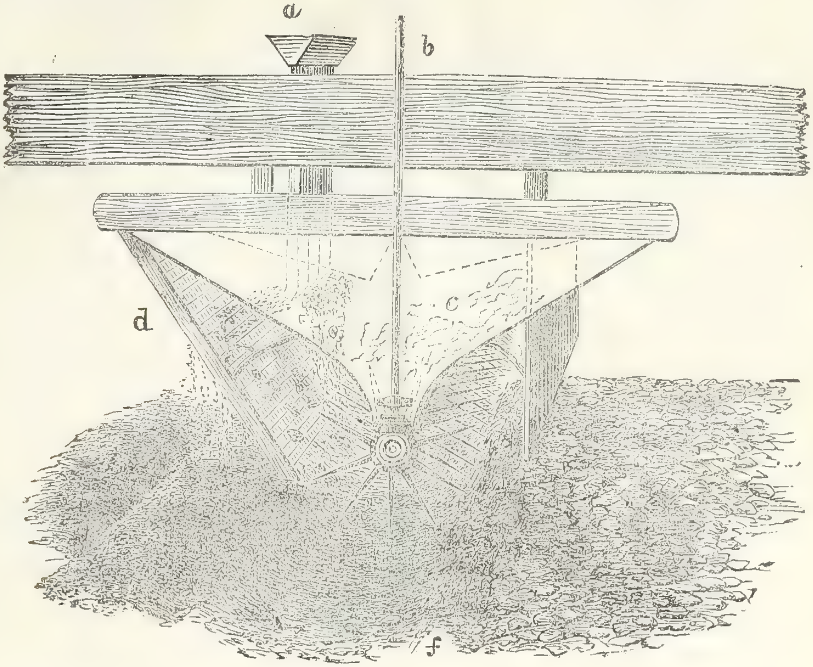
The quantity of land that can be ploughed per day by machinery, suitable to a farm of 1000 acres, is 25 acres; and two, or at the most three, men are all that are required to conduct this or any other operation; and, when time presses, by a change of men, double this amount, namely, 50 acres, may be done in the twenty-four hours, because the operation can be carried on by night as well as by day. I have ploughed on a very dark and rainy night, and although it was too dark to see the ploughs, in the morning we found some excellent furrows turned. You will admit, I am sure, that it is of the greatest importance to be thus able to break up the land in unfavourable weather, or for a rapid autumnal cultivation. This great economy of time is also available for seed-time, reaping, and carting in harvest.

The plough having broken up the land, a "comminutor," or rotary implement, is used, fig. 6 (see next page), in character something like the Norwegian harrow, but driven at a high velocity. I have succeeded in obtaining some remarkable results in reducing obdurate clay to a state of the finest tilth. Its mechanism and operation I will explain as I proceed.

The soil having thus been brought to a higher state of cultivation than it is possible to produce even with spade labour, there can be no difficulty in keeping it in that condition, for it will be seen that, by the guideway system of steam culture, the whole weight of the machinery, engines, and implements, rests upon the rails, and that nothing touches the soil except the implements in operation; no horses will poach the ground with their iron-shod feet; the footprints of the guide and ploughman will no where be seen pugging the clay and treading into a solid clod that which has been reduced to the fineness of garden mould.

The destruction of weeds, earthing up, hoeing, and stirring the earth among growing crops, can only be performed at present during the earlier stages of the growth of the plant, and unless executed by hand labour are always attended with difficulty, and more or less danger, from the impossibility of guiding the implements so as to operate in sufficient proximity to the plant, without running into and destroying some portions of the crop. By this system, however, I am enabled to adjust the implements and cause them to travel at the requisite proximity to the rows at all times during the periods of the growth of the plant. In fact, the hoes can be regulated to such nicety, that the operation may truly be called unerring.

Fig. 6.



All other operations, such as harrowing, clod crushing, &c., are effected by the different implements being adapted to the same, or to some other cultivator, and these are lifted and lowered, and worked by the machinery, as before described in the case of the ploughs, and may, therefore, be easily understood without further explanation. Independently of the machinery which carries the engines and implements, smaller ones are constructed for the purpose of carrying manure, the produce, water, &c. They are of the same width as the large one, from rail to rail, but much lighter and shorter, and the boxes or cart-bodies used are placed at either end, directly over the wheels, of which there are four, two on each side. These small carriages or trucks are drawn by the cultivator, and, when required, are furnished with tanks for the conveyance of water or liquid manure; and this may be distributed among the growing crops, either independently, or during the time when any of the other operations are in progress. For instance, the operations of stirring and distributing water, or liquid manure, to the growing crops, may be performed simultaneously by one implement, in the form of a hollow bar or coulter, stirring the ground to a moderate depth, whilst the water, &c., passes out at the extremity of the bar. By this means the fluid is economized, on account of the evaporation from the surface being prevented; the soil is not caked, nor are the roots drawn to the surface in search of the moisture, afterwards to be injured by the parching of the ground.

The next important operation to be noticed is reaping, which is performed by a machine constructed on the principle of Bell's or Dray's, or it may be of any other good reaper. It is attached by suitable stays to maintain it at the proper level, perfectly independent of any support from the ground, and has the necessary gear for communicating the motion to the cutting knives and other parts of the machine by the steam power; and the depositing of the crop after cutting, is effected by a back delivery.

When manual labour is required for the purpose of weeding, transplanting, or any other light operation, the labourers are carried on to the ground by means of the trucks, upon which they sit or stand while the work is being performed, or while the crop is transferred from the ground to the truck, and by it taken away to the homestead. Thus, it will be perceived that even the injury resulting to the ground by men treading on it is obviated. These trucks may be propelled either by horses or by manual labour if desired.

The Cost.

Having described generally the system, before proceeding to the facts and results derived from my own cultivators, we may consider the cost of the whole system.

First. The cost of machinery, implements, and trucks is equal to that of horses and horse implements required for similar work, and the interest per annum may be taken as the same; but in general I think a less interest would be sufficient. In my case, for instance, with the trucks, the travelling being upon a hard smooth surface, there would be considerably less wear and tear than in carts and waggons in a field.

Secondly. The cost of the rails. The wood system, Fig. 4, is £10 per acre, and the brick and angle iron system, Fig. 3, is £20 per acre.

When we consider the much larger sums than £10 or £20 per acre which have been expended upon land, we shall see that no practical difficulty exists to prevent money rapidly coming in to lay down the rails when the profits are known. The only true commercial way of considering the question is, what will be the returns upon the capital laid out by the system? Do we not know that land used to cost as much as the above sum frequently in draining? That £10 or £15 is paid in marling land? I have known £20 per acre paid for valuations to an incoming tenant in a suburban farm, and I have heard of larger sums being paid by market gardeners. Even on the continent (at Milan), irrigation works have cost as much as £40 per English acre. At Edinburgh more than £30 per acre has been paid for the same; and, according to M. de Lavergne, Mr. Caird, and the *Royal Agricultural Journal*, upon the Duke of Portland's meadows at Clipstone, as high a sum as £120 per acre for irrigation works has been paid.

Some express astonishment that I want to expend almost as much as the fee simple of the land? But what, I ask, does this matter, there being no connection between the fee simple of the land and the amount that you may profitably lay out upon it. Let us look at different modes of cultivation, and beyond, as well as in, our own country. In the following table we see the most extraordinary variety. In one place we see tne outlay 15 per cent. upon the fee simple, in another 1,500 per cent.

	Fee simple.	Outlay	Per centage upon fee simple
In England	£ 30	£10	33
,, ,,	15	5	33
Market gardening	200	30	15
In America	1	3	300
On a sugar estate (with slaves)	6	90	1500

Thirdly, the cost of the operations.

The reduction in the friction of the machinery in consequence of travelling on a hard road, the large breadth of land possible to operate upon at once, and the few men required to attend the machinery in proportion to the work performed, greatly reduce the cost of the operations, while cartage is reduced in the proportion of the difference between drawing a weight on a ploughed field or upon a railroad.

Ploughing is 1s. 7d. per acre; hoeing the whole breadth of 50 feet at once, 3d. per acre; drilling seed the whole breadth, 5d.; harrowing and rolling, 5d.; scarifying and grubbing, 8d.; reaping, cutting, and delivery, 10d.; carting crops off, and manure on to, the land, ½d. per ton per mile.

Facts and Results of the Machinery.

The engines of my large cultivator are a Garratt's 6 H. P. and a Barratt and Exall's 4 H. P. They are old second-hand engines, and, being unequal in power and in weight, are not well-adapted to work together; and the pistons are not tight in the cylinders. Indeed, though I have had the metal packings looked to, and taken in hand by a millwright and engineer, yet are they very imperfect, allowing a considerable escape of the steam. When Mr. Amos, the consulting engineer to the Royal Agricultural Society, saw them on one occasion, in a casual visit, (but no trial taking place,) he thought that a considerable per centage must be taken off in any calculation for arriving at a conclusion on the merits of my system, in consequence of their condition. What the per centage was that he stated at the time I do not now remember; but this is not of any moment, for in my calculations I have made no deduction on that account.

In this paper it is my purpose chiefly to deal with facts; but it is necessary, in considering the future of this system, to be informed that the engines of my cultivator are of a wrong construction for the purpose, and very leaky; next, that the frame-work and wheel-work are very ill-made, and the friction consequently very great; and thirdly, that the weight of the whole is, per horse-power of the engines, nearly double of what it would be upon newly and more perfectly constructed machines.

Ploughing.

I ploughed 12 furrows of 10 inches in width simultaneously, making thus a breadth ploughed of 10 feet, at a speed of 2,400 feet per hour, the depth of ploughing, five inches; the ground was very hard; the pressure of steam was 50lbs. in each engine; the revolutions of the engines, 120 per minute—the steam-cock was about half open. On another occasion, I ploughed similar ground with 48lbs. in the large engine, and 52lbs. in the small one—the steam-cock half open; the speed of ploughing being the same in both.

On another occasion I ploughed ground that was much lighter; it had been ploughed, and then levelled and well rammed (several weeks prior); on this ground I only used a pressure of steam of 32lbs. in the large, and 35lbs. in the small engine.

The above statements show that, on ploughing average land with my machine, I should use not quite 10 horse-power when turning over soil 10 feet wide and 2,400 feet per hour; and, taking out of a day's work of 12 hours one hour for change of ploughs and shifting at headlands, I have 11 hours' effectual work, which gives the following result:—

2,400 feet, the length ploughed in one hour.
10 feet, the breadth of 12 furrows.

24,000 feet, the square feet ploughed in one hour.
11 hours.

264,000 square feet ploughed in one day.

$$\text{And } \frac{264{,}000 \text{ square feet,}}{43{,}560 \text{ square feet in an acre}} = 6 \text{ acres per day.}$$

Now, 10 horse-power, multiplied by 5·7 lbs. of coal per horse-power per hour, (which is Mr. Amos's estimate used at Chelmsford, for calculating Mr. Fowler's steam-ploughing, and which was deduced from trials upon a number of steam agricultural engines, and the coals at 20s. per ton) gives 57 lbs. per hour, which, multiplied by 12 hours' consumption, is 6·1 cwt. per day = 6·1 shillings; to which add 3s. 6d. for one man for wages, and 2s. for another, and 6d. for oil, waste, &c., and we have 12·1 shillings for six acres, which gives 2s. per acre.

For a farm of 1000 acres, 25 H. P. would be required, and, taking the above as a standard, we should have 15 acres ploughed per day; and the calculation would stand 25 H. P. × 5·7 lbs. × 12 hrs. = 15·2 cwt. of coals, to which, add 4s. for one man's wages, 2s. another, 1s. boy, and 1s. for oil, waste, &c., we have 23·2 shillings, which, divided by 15 acres, gives the cost at 1s. 6½d. per acre, with a 25 H. P. cultivator.

If a larger amount of horse-power be thought necessary for more extensive cultivation, the cost will be lessened. With a 40 H. P. cultivator the amount of ploughed land would be 24 acres per day, and the cost would be 1s. 5d. per acre.

If, instead of 5·7 lbs. per horse-power per hour we take the coals at 6 lbs., it would make the ploughing, in the case of the 25 H. P. machine, 1s. 7½d. per acre; if we take the estimate at 7 lbs. of coal, it would make it 1s. 9d. per acre. If we were to suppose that coals were only half the price, namely, 10s. a ton, the last estimate, taken at 7lbs. per horse-power per hour, would sink from 1s. 9d. to 1s. 2½d. per acre.

There is one fact with respect to the ploughing trials above mentioned, to which I would beg to draw especial attention—a fact which appears to me of great importance, namely, the small amount of force with which the 12 ploughs were drawn through the ground when the land was comparatively light, because I think that this will show how, when the cultivation of a farm is carried on without in any operation treading upon the ground, we may expect that ploughing and other acts of cultivation will be performed by my system at much less draught and power, and at much less expense even than is deduced from my own trials. With horse cultivation in my field, had the land been previously ploughed, it would still have required 2 horses to plough it again —the horses would certainly have performed a small per centage more in the day's work—but in the example referred to, we see much more than a small additional advantage. It was there stated that I ploughed 12 furrows with a pressure of steam in the large engine of 32 lbs., and in the small engine of 35 lbs., or say 33½ lbs. in each. Now I found upon trial that it required 20 lbs. of steam to move my machine at its regular speed, without any implememts being in the ground, and it therefore required only 13½ lbs. additional pressure of steam to draw the 12 ploughs. A further pressure of 13½ lbs. (which would have raised it to 47 lbs.) would have drawn another set of 12 ploughs, had I had them to put on, and the amount of ground ploughed would have been 12 acres in the day, with engines working up to 10-horse power. Had I raised the steam another 13½ lbs., namely, to 60 lbs., at which I often work the machine (and with which pressure the engines are working at 13 H.P.) the cultivator would have been capable of drawing another set of 12 ploughs, thus turning over 18 acres per day, with engines only working up to 13 horse power.

In reference to the above, I may remark that ploughs drawn in the usual manner have evidently a very considerable resistance due to their weight on the ground, irrespective of the resistance due to cutting the sod. In Mr. Pusey's experiments this resistance is put down with an average make of plough at 33 per cent. of the whole draught, but it is evident that this resistance, which is a constant quantity, will, in its per centage to the whole draught, vary according to the nature of the soil, whether stiff or loose. The lighter the soil, the greater in proportion to the whole draught will be the per centage due to the weight dragging on the ground. In my case, however, the weight of the ploughs being transferred to, and borne by, the rails (for the plough is suspended to the cultivator, with the point of the share rather lower—½ an inch—than the heel), the resistance due to the weight of the implement pressing on the ground is taken away; and if the soil be very light or loose, only a very small resistance will take place in opposition to the pull or draught of the motive power. This, I think, will explain the remarkable result of the third set of ploughing trials above mentioned.

Where the side of a field or piece of ground is crooked (see Fig. 1), and the line of hedge cannot be straightened, the crooked part is fenced off and used for pasture or in cultivation as usual. This is shown between (*a*) and (*b*). If roads or lanes intervene between different fields, a "level crossing" or moveable rails will enable the machinery to pass from field to field. This is shown at the left-hand corner. If a farm abuts on a railroad, it may communicate with it, and by this means the produce may be sent to towns, without, in its transit, being off a rail; and marl, clay, sand, or other soils, may be brought from distances, and be deposited at any period at a very small comparative sum; by this alone a *permanent* increase in value may often be given to estates. Also manure may be brought from towns and distributed over the land at a very advantageous cost in comparison with that on farms at present.

Small Cultivator.

The small cultivator, to which I before alluded, for the light operations of a farm, or for the total cultivation of a market garden, would be constructed with a 3 or 4 horse-power engine. It is shown in Fig. 7, and is in two parts. The engine portion is distinct from the carriage, but is connected with it by two bars with hooks at the ends, and diagonal chains, which also hook and unhook readily. The diameter of the cylinders of the small engine on the Kensington Cultivator is only two inches, and the pressure of the boiler is generally 40lbs. This is only one-half, or at the best three-quarters of one horse power, and we may well conceive that if so small an engine as this (a mere toy) be considered sufficient to work a Cultivator of a breadth of 30 feet, together with its second carriage, its weight of water, men, &c., how much larger a breadth may be worked by powerful engines.

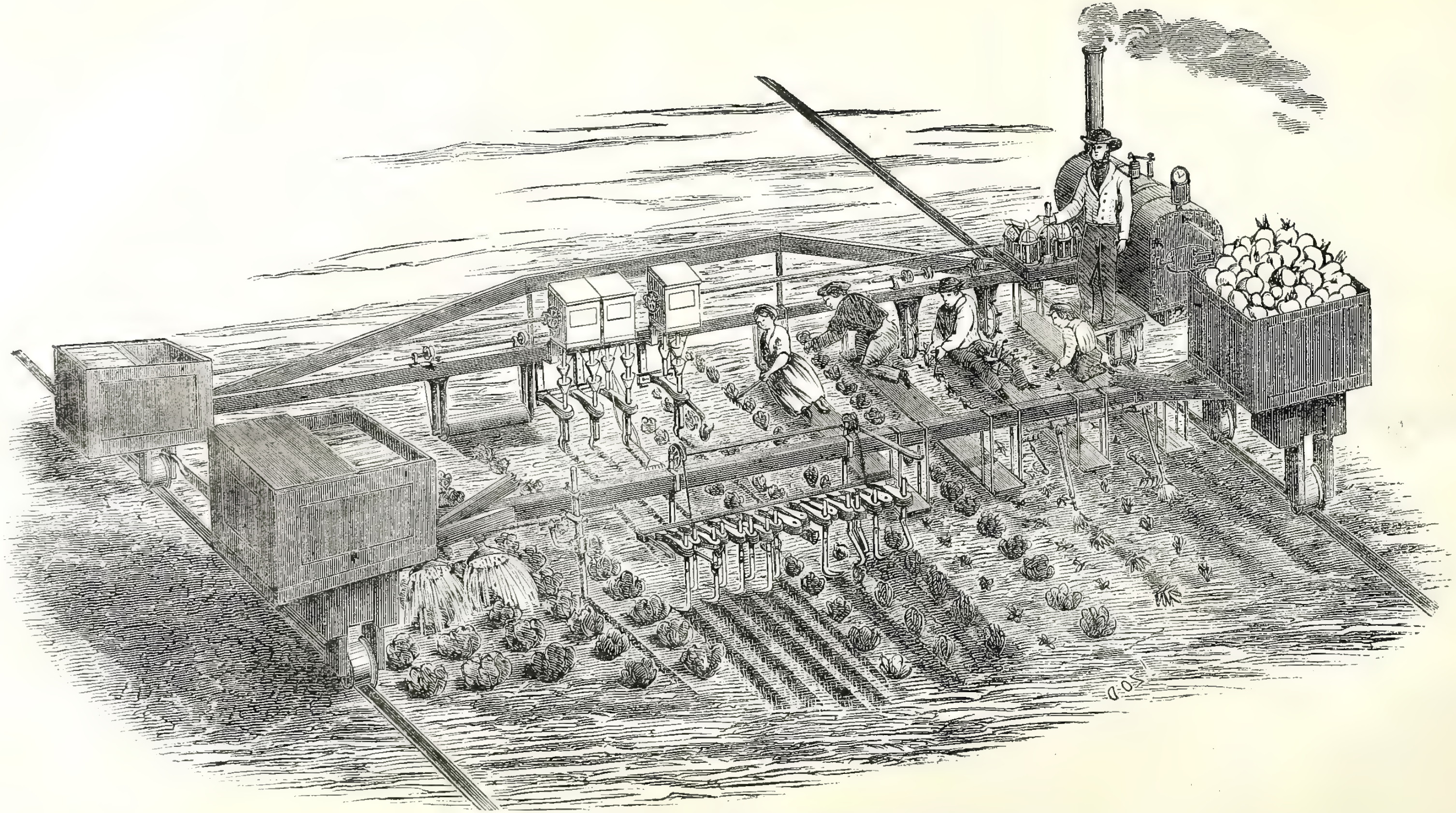
In the commencement of this paper I remarked that it was a fast growing opinion among farmers and many others that steam should and would be made to supersede horse labour in the field. Many farmers, taking the view that my system realizes this opinion, have suggested that the rails might be laid down over several small farms, and the machinery be employed to work from one to the other, but I think that the introduction of the smaller arrangement of machinery, by which farms of 200 acres may be worked, will be a better plan, although not so likely to develope the fullest economy of the system.

The Comminutor.

The onward motion of the comminutor is in a line with the axis of the revolving tines, cutting furrows parallel with the rails on the ground. The ground, which is previously ploughed, is made into a seed-bed as fine as the soil of a molehill by the action of the tines, for a depth of five or six inches; the general depth of the ploughed or broken ground may, of course, be much greater. When the soil is free from large stones the screen *d* (Fig. 6. p. 45) is used, by which means the clods not at first broken are thrown back upon the tines for a second or third blow. I found, in working the machine, that the roots of couch and other weeds were blown over towards *c*, *c*, and deposited on the unbroken side of the land at *f*, *f*, where they were raked up with facility.

In the hopper at *a*, artificial manure is placed, and by a manure distributor, a certain quantity, for a certain distance passed over by the machine, is distributed. The importance of this complete amalgamation will be appreciated when the bearings of chemical science upon the point are perceived. Professor Voelcker, in a lecture, says, "The efficacy of a manure, or the practical effect of which it is capable, is greatly influenced by the mechanical condition of the land. I may illustrate this by referring to experiments I have made on land attached to Cirencester College, where I used superphosphate on a piece of ground which did not yield so much as another piece where none had been used, but I took the precaution to try the manure in a third place, and here the yield was three times as much as on that which had not been manured. The fact is, that on clay land superphosphates are of no use unless the land be properly pulverised. Some farmers imagine that by using the best artificial manures they do not require so much labour, or any additional labour. There can be no greater mistake, for the best artificial manures often fail, more or less entirely, for want of proper pulverisation of the soil. It is of the greatest consequence that the land on which artificial manures are used should be in a high state of subdivision. Artificials can only be used with advantage by farmers who have improved agricultural implements and methods of tillage, and have paid a great deal more attention to the mechanical condition of the land than many farmers of the old school." And I may also quote the distinguished agriculturist, Mr. Hoskyns: "Now our knowledge of the chemical effects of comminution upon the absorptive powers of the soil (based upon the most accurate demonstration of the lecture-room, and speaking to the eye and to the mind as plainly and

Fig. 7



THE KENSINGTON STEAM CULTIVATOR.

Halkett's Guideway Steam Cultivator of small horse-power, for the light operations of a farm or for market gardening, showing:—

Machine Operations:—Drilling corn; drilling seed between the rows of plants; hoeing; rolling; surface watering; watering in rows upon seed and upon young plants; underground watering between rows of plants; carrying crops; carrying water.

Hand Operations:—Weeding, transplanting, dibbling, cross-hoeing, without injury to the soil, or to young plants already upon the ground.

irresistibly, and by the same evidence, as any fact observed in the field can do,) is already far in advance of anything which our present means of mechanical division enables us to realize, even on the smallest practical scale."

If, in looking forward to the future, agriculturists and landowners would take an enlarged view of the past and present state of things, they would perceive that not much new land has been added to cultivation during the last fifty years, nor have the imports of food been large in proportion to the consumption, whilst, in addition, the population is a more meat-consuming one. On the other hand, the population during that time has doubled itself; and, perceiving this, they will see how rapid must have been the tendency to increase in intensity the cultivation of land. It is not too much to suppose that on an average the produce per acre has nearly doubled itself.

One principle upon which I base the profits of my system is simply this: spade labour is sometimes used to cultivate farm crops; it is more costly than horse labour by £3 an acre, and more productive by £3 or £4. And this is true with the same amount of manure in both cases. In testimony of this I refer to many well-known experiments by industrial societies. To "Morton's Cyclopædia of Agriculture," to Cuthill's pamphlets, the "Penny Cyclopædia," the "Spade Husbandry in Flanders," by the Society for the Diffusion of Useful Knowledge; the works of Cuthbert Johnson, &c. Now I can perform the operations by steam and guideway in a manner superior to spade labour at less considerably, after paying interest for rails, &c., than the cost of horse labour; the difference, therefore, in produce becomes wholly a profit.

It may be, however, desired to consider a balance sheet for the year; I have, therefore, introduced two for farms of 1,000 acres, and also one for a market garden of 50 acres.

STATEMENT OF A 1000 ACRE FARM ON GUIDEWAYS OF CREOSOTED TIMBER, AT £10 PER ACRE.

		Annual.
Rail, capital, &c.:—		
(a) Interest at 10 per cent., thus— Capital for rails £10,000.		
Interest on capital at 4 per cent.	£400	
Repairs and renewals at 6 per cent.	600	£1000
Farming capital, &c.:—		
(b) Capital for stock, £2500.		
(c) Locomotive cultivator, with 25 h.p. engines and shunting machinery complete, £1900; implements £300, at 15 per cent.		330
(d) Ten trucks £300, at 8 per cent.		24
Coal, at 20s. per day, and 250 days		250
Oil, &c.		10
Engine driver at 4s. per day, man 2s. 6d., boy 1s.		117
5 constant labourers		155
*Labourers for hand operation upon the crops ...		50
Farmers' annual field expenses		£ 936
Add interest for rails		1000
Cost of cultivation by steam		£1936

Labour at homestead, expenses for marketing, and all other labour which is paid for as in the present system, need not be here alluded to.

STATEMENT BY MR. W. REX, VALUER TO MESSRS. CHINNOCK AND GALSWORTHY, LAND AGENTS, LONDON, AND A FARMER, FOR A FARM OF 200 ACRES, WELL TILLED LAND.

		Annual. £	s.	d.
Capital:—8 horses, 4 ploughs, harrows, horse hoes, scarifiers, 2 waggons, rollers, 4 carts, £500.				
Depreciation of stock at 15 per cent.		75	0	0
Horse-keep, corn, 100 qrs., hay 30 tons ...		245	0	0
Labour, 4 carters, at 12s. per week	£124 16			
1 Horse keeper extra	31 4			
3 Labourers	105 6			
		261	6	0
100 acres corn hoeing, 4s.		20	0	0
Cutting 50 acres of corn at 8s.		20	0	0
		621	6	0
Multiply by 5 for 1,000 acres		5		
		3106	10	0
*Deduct		30	0	0
Farmers' annual field expenses for ordinary cultivation on the fourth or fifth shift system, exclusive of all extra labour for harvest, &c., but including all that can be done by the machinery in the field ...		3076	10	0
Cultivation by steam		1936	0	0
Difference in favour of steam		£1140	10	0

Which is equal to 11 per cent. upon capital for rails, and, when added to 4 per cent. (already allowed), gives a profit of 15 per cent.

The difference between spade labour and horse labour is given in Morton's "Cyclopædia of Agriculture," p. 388, article "Capital," at £3 per acre in favour of the spade, when £8 per acre is average produce. If only £1 extra per acre be allowed, the present horse farming, the profit will be 24 per cent.; if £2 be allowed it will be a profit of £34 per cent. In the above estimate, extracted from Morton, no crops sold off the land, or gardening ones, are considered, only grain and cattle feeding ones.

The balance-sheet of a farm laid down with the brick and iron rails at £20 per acre, will be as follows:—Interest of money and depreciation, £1200; annual field expenses (deducting £96 due to less friction by this one over the other system of rails) £840, which subtracted from £3076, gives a saving of £1036, equal to 5 per cent., and which, when added to 4 per cent. already received, makes a profit of 9 per cent. by saving on labour alone; to which, if £1 for extra produce be added, we have a total profit of 14 per cent.; if £2 for extra produce, we have a profit of 19 per cent. on capital for laying down a most permanent system of guideways; in fact, one of an almost indestructible character.

EXPLANATION OF BALANCE-SHEET.

In line noted letter (a) I say "Interest on capital at 4 per cent." This I suppose to be sufficient interest, the investor being supposed to withdraw the money from the funds or other good security. If the money is borrowed, the interest must be larger, but it will be seen that this makes no difference in the result.

Line (b) "Capital for stock £2,400." No account is taken of the profit or interest the agriculturist makes upon the £2,500, as the same amount of capital is required for horses and horse machinery on the opposite side. Only the interest for depreciation and wear and tear is put down here.

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* This item refers to such operations as hand hoeings and weedings, *combined* with the travelling machinery. Hand operations are in this manner more cheaply performed than they are at present. The above includes 250 acres weeded once, and 250 acres weeded twice.

* There will be a saving of £200 in machinery in a large farm over a small one proportionably, therefore deduct at 15 per cent. on £200.

Line (*c*) "Locomotive cultivator with 25 horse-power." A steam engine will always work up to a higher power than is denominated by its nominal horse-power, and I could easily make 25 horse-power engines work up to 40 horses (the amount of horses given on the opposite side) but this is not why I have put 25 horses in engine power as sufficient against 40 horses on the opposite side; on the contrary, for every one horse-power used in flesh I intend to place one horse power in steam. My explanation is this. 25 horses working 12 hours for 250 days, and 12 hours extra for 20 nights, are equal to 40 horses working 8 hours for 250 days.

Line (*d*), "Ten trucks, &c." The interest for depreciation and wear and tear is put at 8 per cent. in this case, the wear and tear not being great.

I have gone upon the broad principle of putting one horse-power working in steam for every horse working in flesh, but I have overestimated very much, for one horse will cart only one ton with the load running upon the ground, while one horse-power will cart several tons with the load running upon my guideway. I have the advantage of the less draught of the ploughs by their not resting upon the bottom of the furrow-pan, which in Mr. Pusey's experiments was found equal to fully one-third loss of power; and the draught of all implements will be less from the looseness of the soil, from not consolidating the ground by treading upon it; in fact, when we see that market gardeners plough land often at 10 and 12 inches deep with one pair of horses, this will become very apparent, but I think it better to take to myself the advantages which will accrue from better tillage and more frequent hoeings, &c., than to reduce the horse-power of the engines; in fact, practical knowledge will point to the reverse of a reduction being the proper direction. But, howsoever this may be, there is a commercial advantage due to the above facts in my system for which I have not given myself credit in my balance-sheet.

If land is undulating or hilly, it necessarily requires for its cultivation more horses than the same acreage does upon the flat. In the case of my system, I should require the same increase of power; but, inasmuch as the labour bill on my scale is so small in comparison with the labour bill on the opposite side, namely, as £936 is to £3,076, any per centage increase of labour on my side tells considerably less upon profits than it does in horse farming. It may still be objected that the weight of the machinery (the engines and cultivators) being considerable, an amount of waste power will occur greater than that with horses. Now, this will not be the case, for my machinery, including the engines, girders, wheels, and all other parts, can be manufactured at the weight of not much more than one horse for every horse-power of the engines, and as the power expended in rising a hill resolves itself into two elements, the one the draught upon the implement or the load, and the other the rise of the whole weight a certain number of feet perpendicular height in a certain number of minutes; and since, in both cases, the elements are nearly the same, the power expended will also be nearly the same; but as, on my side, the advantage is found, that for every expenditure of one horse-power in horses I can do the same at one-fourth the cost, so whether the land is undulating or flat, I can do the work at a great commercial advantage.

But let me take a question of still greater importance. If it is true that a large amount of cultivation is beneficial, or if a soil be so stubborn as to require an extreme amount of labour, how easily I can give it. For instance, if I employ half as much more machinery, men, and coals, and give an amount of cultivation equal to 50 per cent. more, I can do this at the increased cost of £468, namely, half of £936; while to do the same on the opposite side, would require an increased cost of £1538, which is the half of £3076.

If the amount of labour is increased on a farm, we shall find that on account of the cost of my operations being so small, while the interest upon the rails is a fixed quantity, the advantages on my side rapidly increase. This, which is so much the tendency of the day (especially in an increase of work requiring care), is well met in my system, by its being so admirably adapted to assist in performing and in cheapening the more delicate operations, thus facilitating double croppings, increasing largely the cattle feeding produce, the head of cattle for sale, the manure raised upon the farm, the richness of the soil, and the production of corn.

Profits.

In consequence of the small cost of each operation, it is found that after paying the interest on the money for laying down the rails, and an annual charge per acre for their constant renewal, a saving of from 20s. to 24s. per acre will be effected in the case of well-cultivated farm land. If to this is added from £1 to £2 per acre as the increased value of produce on account of superior cultivation, which is considered by competent judges due to the guideway system, these two sums will form an extra profit of nearly £3 per acre. In the case of a more laboured and profitable cultivation, such as rough gardening and market gardening, the additional profit will rise as high as from five to six pounds per acre. These sums form a profit of from ten to forty per cent. on the capital laid out for rails, which will be shared between the landowners and their tenants primarily, but eventually the benefits will go wholly to the landowners.

At first sight, the advantages in a commercial point of view in the accompanying sheets are apparent as producing a large interest for the necessary outlay for rails, &c.; but not only is this true, but to the landlord the system holds out the greatest benefits, either with or without outlay on his part, by increasing the value of the fee simple of his land, an increase in value which holds to all the future.

For, allowance having been made for interest and depreciation on capital in laying down the rails, the profit becomes in effect an increased rent, and being a permanent increase of double and treble the present rent, it will increase the fee simple of the land to double and treble its present value, in the same manner as the value of land is increased by drainage, or as the improved system of husbandry introduced into Norfolk, and copied into other counties, raised its value from five to tenfold. I have said *permanent* increase of value, for this increase is evidently not only irrespective of the source from whence the capital comes to lay down the rails, but of the depreciation and wear and tear of the rails.

It is evident that the tenant under a long lease will receive all the advantages and profits arising from the system throughout the whole of his term.

Market Gardens.

Market gardens may be admirably cultivated by this system, three-fourths of the present very costly hand-labour being performed by the guideway machinery, with far more benefit to the land, as is testified by competent judges who have seen it in operation, and those very portions of the labour necessary to be performed by hand, such as planting, cross-hoeing, &c., are executed in a far more efficient, systematic, and economic manner. By the avoidance of walking amongst the plants for that purpose, no consolidation of the ground or breaking of the young plants can take place; and the soil is always in a loose and friable state. That most important and now expensive operation to a market-gardener, watering, may be done at a small cost and a greater economy of time and water, without the injury attending the use of water carts, or of a pipe and hose, with their unavoidable injury to young plants. The crops will, from the above reasons, attain a more rapid maturity, and thus an earlier produce, with consequent larger prices, will be obtained by the market gardener.

A respectable and intelligent market gardener, who has often witnessed my operations, writes in a letter:—"I have inspected the guideway on many occasions, and find it most efficacious. There is not an operation which this machine will not do, whether it is trenching, hoeing, drilling, or any other nice work; and there is nothing, in my opinion, so agreeable to the eye as work when thus well done, and with economy, for that is the secret of large profits and small outlay. Clays could be rendered comparatively light, and a season got in a few hours. The 'comminutor' cleans the ground of that dreadful couch in one single operation, the land being ever so foul and stiff, leaving the soil a perfect seed-bed, casting the couch on one side, the stones on the other. * * The crops can be carried without injury to the soil, for carrying crops and distributing manure are two operations very difficult to appreciate, as there are many who have grown large root crops, and suffered greatly from the removal of those crops. I have known many instances in market gardening where a season has been lost owing to the weather being wet at the time of carting. I happen to know a market gardener who grew 50 tons of mangold wurtzel per acre, and sold it on the ground; the person who bought it cut up the land into ribbons, so that the gardener lost the next crop. Had the guideway been there the crop would have been carted off, manure at the rate of 40 tons returned, and the land tilled, and a fine crop of cabbage growing for early spring." I have often had labourers upon my cultivator, and they always appreciated the ease and correctness with which they could perform operations.

Rough gardening, in which the cultivation is on an extended scale, for the growth of potatoes, mangold wurtzel, cabbages, and sometimes corn, with its laborious and very costly culture, and its large cartage, will receive the same advantages.

Balance-Sheet (market garden).

Statement showing the Cost at which Vegetable Produce is now raised for the London Markets, and the Cost at which the same could be done by the Guideway System for a Holding of 50 Acres:—

A Steam Cultivator, like the small one above described, and of 2 horse power, but capable of working for many more hours in the day than horses do, would cost £120, two trucks would cost £40, and all the implements £50; total, £210. The wear and tear of this, at fifteen per cent., would be 12s. 6d. per acre.

In the following Table all the operations that are performed in the same manner in both systems, and therefore amount to the same cost, are not put down.

Potatoes and Collards—(1st Year).

	Cost on the present System, per Acre.			Cost by Steam per Acre.		
	£	s.	d.	£	s.	d.
Trenching at 3d. per rod	2	0	0	0	10	0
Cartage of manure, 40 tons, exclusive of filling, &c.	0	10	0	0	5	0
Hoeings and earthing	1	0	0	0	4	6
Taking up	1	5	0	0	5	0
Collards, digging, 2d. per rod	1	6	8	0	6	0
,, hoeings	1	0	0	0	2	0
	£7	1	8			
Hand operations				0	5	0
				£1	17	6
Interest on machinery				0	12	6
Depreciation, wear and tear of rails				1	0	0
				£3	10	0

Advantage in favour of steam, say, £3 10s. per acre.

Lettuces and Savoys—(2nd Year).

	Cost on the present System, per Acre.			Cost by Steam per Acre.		
	£	s.	d.	£	s.	d.
Cartage of manure	0	10	0	0	5	0
Trenching	2	0	0	0	10	0
Forking, 1d. per rod	0	14	0	0	3	0
Treading and raking	0	10	0	0	2	0
Hoeings	1	10	0	0	4	0
Savoy digging	1	6	0	0	6	0
Three hoeings	1	0	0	0	2	0
	£7	10	0			
Hand operations				0	5	0
				£1	17	0
Interest on machinery				0	12	6
Depreciation, wear and tear of rail				1	0	0
				£3	9	6

Advantage in favour of steam, say, £4.

In market gardening watering is only practised with some crops. It is performed sometimes by watering-pots, for the injury to the land is considerable when it is carried out with horses and carts. The value of such an operation, if done to the extent of ten waterings to a crop, may be computed at from £2 to £10, according to the nature of the plants and the season. It will be a small advantage if this value be taken at £3 per acre. From £4 to £6 per acre is paid by many market gardeners when watering is performed. This is for eight or ten waterings, and is an amount which could be done by the steam engine for 10s. an acre.

The case would then stand thus:—

	£	s.	d.
Advantage in favour of steam	£3	15	0
Add value by watering	3	0	0
	£6	15	0
Deduct cost of watering	0	10	0
	£6	5	0

Leaving £6 5s. per acre, equal to 45 per cent. profit on the total capital, for rails (at £10 per acre), and implements, engines, &c.

Loys Weedon.

The Loys Weedon system of cultivating wheat is also one which could, with great facility, be carried out by my system. I know that scientific men are divided in opinion upon the practicability of Mr. Smith's cultivation being carried on long without exhausting the land, but it, nevertheless, is a fact that for 13 years he has done so, and, certainly, we may say that that which has been done before may, in like circumstances, be done again. The large profit to be derived by carrying it out by my system must be my excuse for bringing the subject before you, and I must add that I do not see how it would be practicable to carry it out by any other system of steam cultivation. The rails forming guides to the implements, and the implements being suspended from above, would enable me to cultivate at all times between the rows of growing corn.

By my steam cultivation, (after paying interest for money, rent, &c.), £5 per acre would be cleared per annum, with wheat at its present low price, and without taking any value for the straw. If such profits could be obtained for only 13 years, the fee simple of average priced land would have been paid twice over. By hand labour the profits are considerably less, and not easy of attainment on a large scale, while, by horses, it is hardly practicable.

The West Indies.

The power which the guideway culture has for working between the rows of the standing sugar cane (which in some soils remain for many years undisturbed), for the purpose of ploughing, earthing the crops, and for performing the hoeings which are so constantly required, renders my system invaluable for this laborious cultivation. The cartage of crops (a very heavy and constant operation) would also be performed. A plantation would thus be rendered, in all its field labours, independent of the inconstant and irregular attendance now obtained, and the crops would in consequence be greatly increased.

The capital required may be thought too great for proprietors in the colonies, but this is erroneous, the cultivation of sugar being one of the most costly and the most profitable in the world.

The money necessary to carry out my system is less than half that required to purchase the slaves for the field work of an estate in America or in Cuba, the daily cost of the work is far less than the keep of the slaves, and as slave estates can compete with free labour estates in our colonies, and the proprietors succeed in making large profits, the system which I propose would evidently give a very large interest for the money laid out, and would free the land of the difficulty attached to its cultivation from the scarcity of labour, or as has been the case in many parts of the West Indies, of having no labour at all to put upon it, and in consequence losing its entire value.

Conclusion.

It must be admitted that the disadvantages under which a new principle of steam cultivation labours in its development by means of *home-made* instead of factory-made machinery is great, but it surely tells much for the probable future of my principle, that with all such disadvantages I had still, in a few months from the time of completing my cultivator, performed the whole range of the operations of the field, and at a cost very small in comparison with that by horses, while, on any of the previously invented principles, after more than thirty years of trial by men, some of large means and well established talent, not one operation has yet been effectually performed by steam power but that of breaking up the land; while, moreover, as I before mentioned, it is hardly in the cost of the operation itself of breaking up the land by steam power in comparison with ploughing with horses, that any claim can be made of a saving; for instance, Mr. Fowler's average ploughing is, by the judges' report, about seven shillings per acre versus seven shillings by horses, and Mr. Smith's breaking up land is computed at a fraction more; but it is rather in some accompanying circumstances that a commercial advantage is gained, such as not treading on the ground during the ploughing operation, and a concentration of power at suitable seasons, enabling a reduction of horse-power, all of which I gain in a higher ratio, for I never tread on the ground in any one operation during the year, and I can concentrate power in a double degree, for I can plough, hoe, drill, seed, &c., at night as well as in the day. In fact, Professor John Wilson, who, you are aware, was one of the judges appointed by the Royal Agricultural Society to award a prize of £500 for the best steam-plough, at Chester, did me the honour to visit my place, and witnessed the various operations, remarked upon the point, when I alluded to it, in these words:—" Of course that which they gain in a degree you gain in the extreme; in fact, your system would make farming operations equal to market gardening."

The following is a list of the operations which I have performed by my cultivators:

I have ploughed, subsoiled, harrowed, rolled, used the clod-crusher, used the Norweigan harrow; I have drilled seed dry and with liquid manure, hoed the crops, used the scarifier, reaped corn, carried crops, carried water, I have watered crops over the surface of the ground and plants, and watered in rows upon rows of seed or young plants to economise water or liquid manure; I have drilled the seed between rows of standing plants, and I have performed the new operations of the "comminutor," weed root extractor and artificial manure distributor, already explained; the underground watering between rows of standing plants, and ploughing by night.

I have enabled the following hand operations to be performed with greater facility to the labourer, great economy in time and cost, and greater regularity than can now be performed, namely, dibbling seed, transplanting, hand-weeding, cross-hoeing, and taking off crops —without, in any case, treading upon the ground or spoiling rows of growing plants interlined between other rows.

Besides these operations, there are many others which are not now performed by machinery or horses, which I expect to accomplish by steam machinery. For instance, I have no doubt of being able to perform dibbling seed, and also, when required, cross-hoeing; and the following very important operation—which cannot be effected by horses—could be easily done by my system, from the fact of being able to pass repeatedly over the same ground without treading or touching the land, and from the facility which I have of concentrating a large amount of power upon any one portion of land at one time.

The ground is first ploughed one deep furrow, say, in autumn. It is then lifted by a suitable broad-lifting plough, and laid in wide ridges, leaving broad pans of about four feet in width. The pan is then ploughed and sub-soiled, part of the mould at the same time becoming mixed by the operation with the bottom soil, it is then left for the weather and the winter's frosts to act upon it. Afterwards the ridges are split down and the land levelled for forming the seed bed, or the sides may be split down and the operations reversed, and that part lying under the first ridges be sub-soiled and exposed. By such operations, in the course of a short period, without bringing to the surface any of the sub-soil, or any more of the sub-soil than is desired, land may be reduced to a fine deep mould.

Taking a review, therefore, of all the advantages of the system, comprising the ability of concentrating a large amount of power, as shown in the bouting of land, and so far as time is concerned by working twenty-four hours in the day; the advantages of my "Comminutor," the facility for performing the most delicate operations, the absence of all treading upon and consolidating the soil, and thereby the avoidance of injury to growing plants; the ability to water growing plants without injury to them and at a small cost; the ability to cart at all seasons and in all weathers; and, lastly, that this can be done at a considerable diminution of cost, all interest on rails and machinery being much more than covered by the saving on labour; do we not see the vast power which steam has, not only to master all the difficulties and effect all the operations of agriculture, but also greatly to improve the processes, proving the truth of the writings of Mr. Wren Hoskyns, in which such a result is foreshadowed, and in whose more eloquent words let me conclude a paper, far too long, I fear, for the patience of my hearers. "Circumstances, (says that gentleman) likely to form hereafter an important feature in the history of the present time—an unprecedented expansion in the trade of the country—emigration on an extraordinary scale to the gold-fields of America and Australia, acting almost simultaneously with a serious reduction in the population of the Sister-kingdom, and all tending to the same result, a home for the scarcity of labouring hands, have created a demand for agricultural machinery heretofore unknown, and revived the half-abandoned question of the application of the steam-engine to the culture of the soil. The long cited example of its general use in manufactures, and the revolution it has wrought in every other branch of art, has given place to the closer argument of the actual and now familiar appearance in the farm-yard itself.—The mere habituation of the eye is the best of all arguments in cases of this kind; the farmer who has once had a travelling steam thrashing machine in his field or yard, is prepared to hear, if not to ask the question, why its services should not be extended further; he sees the simplicity of its workmanship and the ease and docility of its movements, and its striking concentration of power into small compass. If it is to be expected, as most of those who have given any notice to the subject appear to admit, that the steam-engine, whenever it is successfully applied to cultivation, will cause a revolution, as well from the manual as from the horse-power methods of effecting it, it is not less likely that it will in a corresponding degree improve the process itself, and present a result comparatively perfect. Given the accomplishment of the act, the rate of intrinsic improvement in the act it almost foredetermined."

DISCUSSION.

Mr. W. **Smith** begged to ask Mr. Halkett whether he had correctly understood him to state that the proportion of power required for moving the machinery itself really was five-eighths of the whole power exerted in the performance of the work, as stated in the paper. Another point was, in taking into account the interest of the capital invested, Mr. Halkett merely referred to the cost of laying down the rails. He (Mr. Smith) wished to know whether he had included the cost of the machinery, and the entire apparatus; because, if the calculation referred merely to the cost of the rails, he considered that a very material element had been omitted.

Mr. Alderman **Mechi** said—Having had an opportunity of examining the operation of Mr. Halkett's system of cultivation in very bad weather, he had no hesitation in stating his impression that all the statements which Mr. Halkett had just made would be borne out by the results when put into practice. He knew that that was not the opinion of many of his practical friends; but there could be no doubt that what had been done by the locomotive engine on railways, might in some degree be taken as an example of what was possible under the proposed system. They found that engines drew after them, at high velocities, trains of 200 tons, at a cost of not more than half-a-crown per mile for the working expenses. Might not a similar reduction of cost be hoped for in agricultural operations? If he had correctly understood Mr. Halkett, £10 per acre was the cost of the wooden rails, and he (Mr. Mechi) believed they could be laid at that price. The interest of that and the wear and tear he would take at 15s. per acre. He believed it was well understood that the cost of horse and manual labour upon a farm was something like £3 per acre as regarded the arable portion of the land. If 20 per cent. on that was saved by the plan now proposed, that would be 15s. on the £3, which would pay for the interest of the rails. He also understood Mr. Halkett to say that the cost of his machinery might be set against the ordinary cost of the horses and the usual farming implements, which he (Mr. Mechi) believed to be quite true; and this, he thought, would be an answer to the gentleman (Mr. Smith) who had just made some remarks on that subject. They all knew that, practically, wherever they could bring steam to bear, horse-power could not in any way compete with it, either with regard to economy, endurance, or opportunities for cultivation. Therefore, the whole question might be said to depend upon whether the annual saving under this system would be equal to the interest on the amount of the fixed capital laid down in the rails. That, he thought, was the essence of the question. But when they considered the numerous advantages of the plan which he had witnessed—that it could be used in all weathers, except in hard frost, and used untiringly, and also at night—there could be no doubt that the opportunity of doing the work at the very time that it was wanted, and, above all, the superior manner in which the work itself was done, would more than compensate for any loss of interest upon the cost of the rails. He could only say, that he had witnessed the machine at work with eight ploughs and two subsoil ploughs, and the soil was lifted and thrown over in a manner which exhibited a most favourable contrast to the ordinary mode of ploughing. The ploughs, hanging as they did from the framing of the machine, acted with perfect accuracy, and nothing could move them from their line of working. The implements might break, but they could not alter their position, and would perform the work with an accuracy unknown to horse power. He had no doubt some of his friends would put him down as being rather "fast" upon this subject, but he had applied common sense and calculation to it, and he would say that he felt personally indebted to Mr. Halkett for the lucid manner in which he had brought forward his system, and the evidence with which he was prepared to prove that which he had stated.

Dr. **Matthew Truman** remarked, that according to the statement of Mr. Halkett, large farms of 1,000 acres or more presented the greatest facilities for the full testing of this system of cultivation; but farms of that extent were not to be found in all parts of the country, nor were the fields joined together in the manner best calculated for carrying out this operation. He should be glad to know what was the minimum quantity of land to which this system would be applicable. Mr. Halkett had spoken of market-gardens, but those were cultivated in a very different manner to the generality of farm land throughout the country. It appeared that it was not adapted to every form of cultivation, and if the employment of horses was necessary for exceptional cases there could not be sufficient occupation for them throughout the year. He apprehended that, unless the entire estate were laid out very much in the form they saw in the diagram exhibited, the business of a farm of 1,000 acres could not be conducted entirely without horses; and he thought that was so much deduction to be made from the profit that was supposed to accrue from the adoption of this system. It appeared to him to be a most important subject and one in which all agriculturists must feel great interest.

Mr. **William Hawes** would raise a question or two, which had nothing to do with the actual machinery employed, but rather with the cost at which it could be applied. He regarded it as next to impossible that tenant farmers could incur the expenditure necessary to carry out this system whilst they stood in the position of tenants-at-will, or on short leases. The question of long or short leases was a vexed one amongst the agricultural community, and he thought it one of the legitimate objects of this Society to look at the question not merely as to the pecuniary cost of cultivating the land, but, having ascertained the fact that a great improvement could be introduced into our agricultural system, it became them to inquire whether an antiquated system of legislation had not tended to retard improvements, and and check that which might otherwise be a great public and national benefit.

Mr. Mechi wished to ask Mr. Halkett whether he had ever worked the engine at a higher pressure than from 40lbs. to 50lbs. to the square inch, seeing that railway locomotives would commonly work at as high a pressure as 120lbs. to 140lbs.; and also, whether he did not think advantage would be gained by working at a higher pressure than that mentioned, making the relative cost less for wear and tear?

The Earl of **Caithness** remarked that 120lbs. pressure was only an average one for railway locomotives, and a pressure of 140lbs. might, in his opinion, be as safely employed in steam culture as in any other operation. He would ask one question of Mr. Halkett with regard to these rails. It appeared, from the diagram exhibited of the machine in operation, that the rails were laid down in long lengths, and that all such obstructions as hedges and ditches were removed. Such a course, he believed, was attended with great advantages in farming;

but it would be a matter of considerable expense, either to the proprietor or the tenant, to fill up the ditches and clear away the intervening hedge-rows. That was an item which he suggested ought fairly to be added to the expense of introducing the system of cultivation now under consideration. He would also ask, in what lengths the rails were laid down, and how they were fastened at the junctions—whether fished, or in what way they were put together; and further, whether they were intended to be permanent rails? A friend of his had remarked that this system would be a most disagreeable accompaniment to a farm, inasmuch as the laying down of these rails would effectually destroy foxhunting, as horses would not like to go across the fields in which the rails were laid. Knowing that John Bull was very fond of foxhunting, and the English farmer liked good horses, he would almost be sorry to see the country spoiled for this old English sport. At the same time, he was a great advocate for anything which would enable farmers to employ steam as the means of cultivating land. He believed it was capable of being done. Whether Mr. Halkett had exactly propounded the way in which it was to be effected remained to be proved. Mr. Smith's mode of steam ploughing, from what he had seen of it, was exceedingly good, and he was sorry he had not had the opportunity of witnessing it upon a large scale. He had seen it in operation at Windsor, on the occasion of Mr. Fowler exhibiting it to the Prince Consort, and the experiment was quite sufficient to demonstrate that ploughing could be done well by steam. He had this year given to Mr. Fowler the offer to plough 200 acres of land for a friend of his, but he received an answer from Mr. Fowler to the effect that he did not undertake ploughing himself; but his advice was that the farmers of a district should club together for the purchase of an engine and apparatus for steam ploughing. If that could be done, he (Lord Caithness) believed it would be a most advantageous plan. He believed if any one would establish a steam plough in a district, and let it out, although there might be some loss in the first instance, yet, if the practicability and advantage of ploughing by steam were demonstrated, the great difficulty would be got over. The great objection to this system was, that he was afraid they would not get persons, especially farmers, to lay out the large sum that was required to carry out Mr. Halkett's plan of culture. The system itself was extremely beautiful, and, with the rails properly laid and fish-jointed, he had no doubt excessively good work could be done, without that detriment to the land which was occasioned by the trampling of horses' feet. With regard to the operation of hoeing, he felt interested in that process, particularly with reference to turnips; but the objection to this plan, as applied to turnips, he apprehended would be, that when the hoeing was done by machinery, the healthy plants might be hoed up and unpromising plants left behind. When the hoeing was done by hand, the strongest plants were allowed to remain. Upon the whole, he thought farmers generally would not regard this system with a favourable eye, more especially as it appeared by the diagram that there was a little corner which, from its shape, must be cultivated by the ordinary means.

The Chairman said, that the noble lord who had just sat down had spoken most favourably of the use of steam, but his lordship appeared to think the farmers were so benighted a class, that they had not the spirit to club together to raise a few hundreds to bring it into operation. He (the Chairman) might appeal to Mr. Shuttleworth and Mr. Howard, whether, when farmers were convinced of the advantages of employing a steam engine, they did not at once procure one. He could mention the fact, that in one locality, with which he was well acquainted, the farmers had formed a company, and had purchased and set to work four of Hornsby's engines.

Mr. George Shackel remarked, that this subject had been alluded to by the noble lord as a tenant's question. He (Mr. Shackel) would rather it had been introduced as a landlord's question, as that was certainly the light in which he regarded it. It was not to be imagined that a farmer with 7 or 14 years' lease, would embark in the necessary outlay. It was not his wish to throw any obstacles in the way of this plan; for with wheat at 40s. a quarter, it would be a great desideration with the farmer to have a system introduced that would enable him to obtain a fair profit. With regard to the hoeing of turnips, the farmers were only too glad to get plants at all, without exercising any great nicety in selecting the strongest plants in the operation of hoeing.

Mr. Howard would say one word with reference to what had just fallen from the Chairman. He (Mr. Howard) could answer for the tenant farmers, that they were not wanting in spirit in adopt any system that was proved to pay. The farmers were a very calculating class, and he was convinced that if they were made acquainted with the existence of a really good invention they would not be slow to try it. He (Mr. Howard) had been a good deal connected with Smith's steam ploughing tackle, and could state that there had been no trouble in disposing of 40 sets of the steam cultivating apparatus, upwards of 30 of which had been sold to tenants. That fact was alone sufficient to redeem them from the aspersion that they wanted spirit to adopt inventions which they knew to be really good and practically valuable. He agreed with Mr. Shackel in considering the introduction of this system as a landlord's question, and if the proprietors of land would go to the expense of carrying out this plan of Mr. Halkett's, the tenant farmers would only be too happy to make use of it. With regard to the power of traction exerted by the machinery, he believed the London and North Western Railway Company had not an engine that would take a load up an incline of 1 in 15, at the rate of 10 miles an hour.

The Earl of Caithness said, with reference to the remark of Mr. Shackel, that the farmers were only too glad to get turnip plants of any kind, and were not careful to select the stongest plants in the hoeing, he (Lord Caithness) would say that that was not the plan adopted in Scotland. He did not mean to assert that the English agriculturist was behind the Scotch, for they all knew what the English farmer could do, but in Scotland the practice was to select the finest plants in hoeing.

The Chairman took the liberty of suggesting that this was not the time to discuss the comparative merits of Scotch and English farming.

Mr. S. Sidney had the opportunity of knowing that the farmers of England were rather in advance than behindhand in the desire to employ steam in the cultivation of the land. It was in fact the want of the present time, and if one thing was more remarkable than another in the progress of agriculture during the last ten years, it was the extreme rapidity with which the farmers had come to make use of steam, if they had anything offered them that they were sure would pay. Large sums of money were waiting to be invested in that way, when once the farmers were sure that an implement had been produced which would not be rendered valueless by after improvement, or reduced in value and utility by modifications from time to time. With respect to the interesting paper of Mr. Halkett, he had waited in the expectation of hearing farmers present speak upon the subject, but he feared the time had scarcely arrived when farmers were prepared to give an opinion upon it; and, with regard to those who were engaged in designing improvements in the application of steam to agricultural purposes, they were so much engaged in trying to perfect their own inventions that they were not prepared to say much about other plans. They must all thank Mr. Halkett for the way in which he had brought this subject before them. He confessed that when he first saw the plan, the difficulty which presented itself to his mind was that the sinking of a large capital in the land would not be received in a favourable manner. It was only due to Mr. Halkett to say that his paper possessed the advantage of being so clear and so lucid that they could not fail to understand his system; but at the same time it was evident that it could only be applied to certain forms of culture. But, putting aside that minor point, it was impossible not to see that the difficulties were not mechanical, but financial. It was not easy to find persons prepared to sink so large a capital in the soil as this new system called for. He drew a broad distinction between the farmer who was prepared to lay out from £500 to £800 for a steam engine, which was applicable to the operations of the farm generally, and him who might be inclined to lay down the permanent system of works advocated by Mr. Halkett. It was his (Mr. Sidney's) hope that ere long they should find another Mechi, prepared to invest capital, as that gentleman had done in trying a great experiment. Mr. Mechi had obtained a reputation and a good name in the agricultural world, which he (Mr. Sidney) hoped would fire the enterprise of some younger man to take a farm, and lay down Mr. Halkett's system: and he felt convinced if that were done, such crops would be grown as would astonish not only those who were unacquainted with farming, but also surprise those who were practically engaged in agriculture. In the present day, in consequence of the necessity which had arisen for obtaining increased production from the land, and in consequence of the improved condition into which the strong clay lands had been brought by drainage, attention was turned to more completely cultivating the land than had hitherto been done; and they would imagine what a demand there was for efficient cultivation, when he told them that a friend of his, who held a strong clay land farm, informed him that he was driven to the adoption of steam ploughing in carrying out the autumnal preparation of the land, so as to make the best of his farm, for it was not in such cases so much a question of economy as between horse-power and steam-power, as a question of time, and the taking advantage of the seasons. If farmers desired something which economized time, and enabled them to get through, before Christmas, that which was formerly spread over the greater portion of the year, it only became a question what system they should adopt. He did not despair of seeing Mr. Halkett's plan adopted in some places; but it must first be done by some gentleman who went into the matter to make for himself a reputation without any hope of profit. He thought the calculation of percentages as brought forward by Mr. Halkett was a delusive one. There was no comparison between the case of land worth £6 an acre, with an outlay upon it of £90 per acre, or 1,500 per cent. and Mr. Halkett's system. In the former case the culivation was by slaves, who were a saleable property, and not invested capital in the soil; therefore that 1,500 per cent. did not in fact represent the capital sunk in the land. The difficulty in Mr. Halkett's system was that the capital was not invested in a class of property which could be sold or mortgaged but which stood in the same position as the working plant sunk in a mine. The suggestion was made by the noble lord who had addressed them, that the features of the land in most parts of the country would require to be altered in order to adapt it to Mr. Halkett's system; the plan of levelling large hedge-rows, however, was now being carried out to a considerable extent in several parts of the country. They must at least give Mr. Halkett the credit of having brought forward a perfectly feasible plan, which he (Mr. Sidney) would like to see carried out by some of those landed proprietors who from time to time fortunately come forward to employ their capital for the public good.

Mr. BAILEY DENTON said he, like Mr. Mechi, had paid some attention to what Mr. Halkett had been saying. He could not help expressing some regret that Mr. Halkett still adhered to figures in estimating the cost of the rails, which he (Mr. Denton) believed were too low. He entirely echoed the statement of Mr. Mechi as to the beautiful manner in which the different operations were executed by Mr. Halkett's machinery, but in the introduction of that system they must not only knock down the hedges and fill up the ditches, but it would also be necessary to level the surface of the country similar to the fen lands of England. He could add, that the system of Mr. Halkett was peculiarly suited for market-garden purposes, and the great reason why it had not been introduced upon those occupations was owing to the small scale on which they existed in this country, but were it possible to construct market gardens of a size to make it worth while to try this system, he believed it would answer very well.

Mr. HENRY SMITH, as a practical farmer, wished to know whether, presuming these rails were laid down upon certain lands upon a farm of 1,000 acres, horses could be entirely dispensed with as regarded the apparatus itself. He would also be glad to know by what means the produce was conveyed from the fields to the homestead; also, how the manure was carried from the farm-yard to the land.

Mr. CORNELIUS WALFORD urged the desirability of rendering the discussion of this subject as practical as possible. With the present low prices before shown, it would be necessary for farmers to adopt some other system than the present one for cultivating the land. Looking at the tone of the discussion, he was led to the observation, that whilst the meeting saw the necessity for the introduction of some new method of culture, they were not at present in a position to pledge themselves to this or any other scheme. His opinion of the tenant farmers was, that they would readily adopt every real improvement that was introduced into the science of agriculture.

Mr. HALKETT said, in answer to Mr. Smith, that the interest on machinery and implements was the same as that for horses and horse machinery. In answer to the question as to the size of the farm, he said that the system might be used with the small machinery for farms of only 200 acres. In reply to Mr. Mechi, he thought that the question of increasing the pressure of the steam was quite an engineering one. In his own opinion it would, perhaps, be better, but if the pressure was increased, and the cylinders were the same size, the boiler must be enlarged; in fact, the power of an engine very much depended on the size of the boiler. With regard to an observation made by Lord Caithness, in reference to hedges, he (Mr. Halkett) always understood that taking down a hedge paid for itself. He believed that it was his lordship who remarked that by this system larger crops would be obtained. He (Mr. Halkett) felt sure that one had but to see the fine crop of mangel wurtzel grown by Mr. Smith with his steam plough, to be convinced of the advantages which were to be obtained by not treading on the ground during the ploughing, while in his (Mr. Halkett's) system the ground was not trodden upon at all in any operation. In reply to Mr. Howard, of Bedford, he said, that locomotives could be made to go up a steep incline if they were, by a proper arrangement of machinery, made to reduce the revolutions of their wheels to the proper speed. They would then be able to go up much more than 1 in 15, even as much as 1 in 5. But locomotives were made for speed—to go 40 or 50 miles an hour. He did not mean to say, that in any case they would be able to draw a train up a steep incline, for the wheels would slip; but in his case it was quite different, for, as he had before explained, all his wheels were driving wheels. He begged to thank Mr. Sidney for the flattering terms in which he had spoken of his paper; with reference to the remarks upon the 1500 per cent. of outlay upon the fee simple of land upon sugar estates, he was only stating a well-known fact; this included slaves, buildings, and machinery, and he

(Mr. Halkett) could see no difference in the case. If the one was mortgageable property, so were his rails. He of course only argued upon the supposition that the system had been proved to be valuable. Mr. Halkett agreed with Mr. Bailey Denton in considering the brick and iron rail, which was the most costly of the two, the best. With reference to the cost at which they could be laid down, he had had them actually constructed, and the entire cost of material and labour had been noted.

The CHAIRMAN, in closing the discussion remarked that they should not encourage in that room the notion that farmers were, for the most part, the stupid, benighted race which some persons chose to designate them. No doubt there were many uneducated farmers, as well as poor farmers, and many tenants probably held larger occupations than their means justified. They did not want the Society of Arts to tell them these facts. What they wanted on the part of this Society was to point out the importance of mechanical principles, and to call to the aid of the farmers the application of those mechanical principles. The position in which this question stood was this—In the first place, farmers, from the north to the south, and even including the benighted west, were alive to the importance of steam cultivation. In the agricultural exhibitions of the country it was found that nothing tended to attract so large an attendance as the announcement that a steam engine, working a large number of ploughs, would form a feature of the exhibition. At present there were three systems of steam cultivation before the country, two of a locomotive character, and the stationary system. There was the locomotive system upon a moveable railway, introduced by Mr. Boydell. Then there was the system that had been explained that evening, of a fixed permanent line of rails; and thirdly, there were several forms of stationary engines, acting upon machinery by means of long wire ropes. All these were now before the mechanical and agricultural world, and they only awaited the getting over of some practical difficulties, which they looked to the engineering talent of the country to surmount. His friend Mr. Mechi, had opened the discussion in a thoroughly practical manner. The simple question was, whether the saving effected by Mr. Halkett's system was greater than that of horse-power, or rather, whether the comparison of interest upon the fixed capital invested would show a balance for or against the former. He might be allowed to say, that he came into the room with some prejudice against Mr. Halkett's system, and he was even disinclined to take the chair, lest it should be regarded by his friends as an indication of his approval of the plan; but he felt bound to say, that what he had heard that evening had led him to take a much more favourable view. If Mr. Halkett wished to win the agricultural mind to his plan he must show what was the utmost amount of capital necessary to be invested, not only in the first outlay for the rails, but also in getting the whole system into operation. These were matters which the agricultural mind was apt to overrate, and which, on the other hand, the engineering mind had a tendency to underrate, for they knew very well that English engineers were ready to undertake anything, if the money was only found them. In the same way, he believed, the farmers were ready to adopt any change, if it was shown, not merely upon paper, but in the field, that it would pay them. He begged to propose a vote of thanks to Mr. Halkett for his valuable and highly interesting paper.

The vote of thanks having been passed,

MR. HALKETT, in acknowledging the compliment, remarked that he was willing to submit his system to the severest tests that could be applied to it. He had invited the examination of the most eminent engineers of the day, amongst others, Mr. William Fairbairn and Mr. Amos. He was open to the most searching investigation with reference to cost, and was ready to test his system in any locality in which it might be deemed desirable, in order to prove the correctness of the whole of his statements.

The Secretary announced that on Wednesday evening next, the 15th inst., a Paper, by Mr. E. J. Reed, "On the Modifications which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence," would be read.

MEETINGS FOR THE ENSUING WEEK.

MON.......London Institution, 7. Prof. Tyndall, "On Light."
British Architects, 8. Mr. John Bell, "On the Geometric Treatment of Sculpture."
Geographical, 8½, at Burlington House. I. MM. Peschusof Vasilief, Radde Usoltzof, Parg chefoki, &c., "Notes on the River Ameir and the adjacent districts." II. Mr. G. J. Pritchett, "Explorations in Ecuador, 1856 and 1857."

TUES. ...Syro-Egyptian, 7½. I. Mr. Marsden, "On Certain Discrepancies in the Reading of Hieroglyphs." II. Mr. Sharpe, "On the Date of the Crucifixion."
Civil Engineers, 8. Annual General Meeting. Reading of the Annual Report, and Ballot for Council.
Med. and Chirurg., 8½.
Zoological, 9.

WED. ...London Institution, 7. Conversazione.
Society of Arts, 8. Mr. E. J. Reed, "On the Modifications which the Ships of the Royal Navy have undergone during the Present Century, in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence."
Geological, 8. I. Sir R. I. Murchison, "On the Old Red Sandstone of Elgin and the Neighbourhood." II. Prof. T. Huxley, "On Some Reptilian Remains from the Old Red Sandstone of Elgin."

THURS....Chemical, 8. I. Mr. F. Field, "On some Minerals containing Arsenic and Sulphur." II. Mr. E. Riley, "On the Detection and Distribution of Titanic Acid." III. Dr. Medlock, "On the Presence of Ammonia in Ice, and on the Action of Ice-Water upon Lead."
Linnæan, 8. Mr. D. Hanbury, "On Two Insect Products from Persia." II. Mr. D. Oliver, "On the Indian Species of *Urticularia*," On the Structure of the Stem in *Caryophyleæ* and *Plumbagineæ*."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, Nov.* 26, 1858.]

Dated 8*th November*, 1858.

2497. W. Hale, John-street, Adelphi, London—Imp. in rockets.
2199. T. B. Marshall, Queen-street, Cheapside—Imp. in drums.
2501. J. F. Amblet and A. Polart, Amiens, France—Imp. in the manufacture of elastic fabrics.

Dated 9*th November*, 1858.

2593. J. S. Dawes, Smethwick house, near Birmingham—A new or improved machine to be used for cultivating land, and which may be made applicable as a hoe, a skim, a turf or peat cutter; and a new or improved method of actuating the said machine and other machines used for like operations.
2505. J. L. Jullion, Aberdeen, N.B.—Imp. in the manufacture of paper.
2507. A. Henderson, Gloucester-place, Portman-square—Imp. in vessels, and in applying rudders thereto.
2509. C. A. Bulkley, New York, U.S.—Imp. in the apparatus for ginning and cleaning cotton. (A com.)
2511. S. S. Marling, Stanley-park, and J. Apperley, Dudbridge, Stroud, Gloucestershire—Imp. in the construction of fulling machines.
2513. A. V. Newton, Chancery-lane—Improved apparatus for obtaining extracts or decoctions. (A com.)
2515. B. A. Brooman, Fleet-street—Imp. in electric telegraphing. (A com.)

Dated 10*th November*, 1858.

2517. J. Norman and R. Hannah, Glasgow, Lanarkshire, N.B.—Imp. in furnaces.
2519. J. Buchanan, Greenock, Renfrew, N.B.—Imp. in propelling vessels, ships, and boats.
2521. G. Schmidt, Caroline-street, Bedford-square—Imp. in the construction of core bars.
2523. G. Schmidt, Caroline street, Bedford square—Imp. in the manufacture of cast-iron pipes.
2525. G. Schmidt, Caroline-street, Bedford-square—Imp. in ladles employed when casting metals.
2527. C. T. Judkins, York-road, Lambeth—Imp. in gas regulators.

Dated 11*th November*, 1858.

2529. J. and W. Lees, Oldham, Lancashire—An imp. in the construction of oil-cans.
2581. E. H. Maberly, Stowmarket, Suffolk—Imp. in the construction of ships of war and other vessels, their machinery and appurtenances.
2533. A. V. Newton, Chancery-lane—Improved apparatus for securing doors of safes, closets, and apartments. (A com.)
2535. J. Rae, Alpha road, New-cross, Kent—Imp. in cisterns suitable for containing water for household uses.
2537. J. Buchanan, Greenock, Renfrew, N.B.—Imp. in propelling vessels, ships, and boats.

Dated 12*th November*, 1858.

2539. J. Ogden, Liverpool, Lancashire—Imp. in shuttles for looms.
2541. D. Turner, High street Whitechapel—Imp. in the manufacture of wood soles for clogs, boots, and shoes.

Dated 13*th November*, 1858.

2543. M. N. Mills and N. Sidebotham, Ashton-under-Lyne—Certain imp. in looms for weaving.
2545. J. Wadsworth, Salford, Manchester—Imp. in the construction of moveable or adjustible heels for boots and shoes, and of spurs adapted thereto, to be used therewith.
2547. J. Courage, Horsleydown, Surrey, and F. Bennett, Holywell, Flintshire—Imp. in furnaces for reducing and smelting ores, scoria, slag, and waste.
2549. D. Auld, Glasgow—Imp. in furnaces and boilers, and in the generation and treatment of steam.
2551. L. Petre, Hatton-garden—Imp. in the application of glass to ornamental and useful purposes.
2533. M. L. J. Lavater, Strand—Imp. in the manufacture of mats, coverings for floors and other surfaces, and other cellular articles when india rubber compounds are used.
2555. A. B. Woodcock and J. M. Dunlop, Manchester—Imp. in covering rollers, shafts, and tubes of any figure or material, with elastic shells or covers of vulcanised india-rubber, or other elastic substance, and in turning or grinding the surfaces of such elastic covers or shells.
2557. M. Pullan, Horsforth, near Leeds—Imp. in machinery for drying yarns and other materials.

Dated 15*th November*, 1858.

2559. S. St. Clair Massia, Welbeck-street, Cavendish-square—A new economical guard for candles and wax lights.
2561. A. Dick, Holywell, Flintshire—A new or improved manufacture of a yellow pigment.
2563. B. Predevalle, Hart-street—Imp. in producing or obtaining motive power.
2565. M. G. Deschamps and A. J. Quinche, Rue Beaubourg, Paris—A new compound metal called lutetia metal.
2567. W. Clark, Chancery-lane—A new mode of advertising. (A com.)

Dated 16*th November*, 1858.

2560. J. Brennand, Manchester—Imp. in the method of effecting the locomotion of carriages, which impoovements are also applicable to other similar purposes.
2571. J. C. Boisneau, Chatelleraut, France—An improved horse-mill or gear.
2573. J. Samuel, Great George-street, Westminster—Imp. in sleepers or bearers of rails.
2577. T. Knauth, New York, U.S.—Imp. in fire-arms and ordnance. (A com.)

Dated 17*th November*, 1858

2579. F. A. Gatty, Accrington, Lancashire—Imp. in producing certain colours on cotton, linen, and silk fabrics.
2581. M. A. Muir and J. McIlwham, Glasgow—Imp. in looms for weaving.
2583. C. F. Vasserot, Essex-street, Strand—A flat clothes smoothing-iron, with moveable handles. (A com.)
2585. D. W. Hayden, Coleman-street, Arlington square—Imp. in apparatus for heating water and other liquids.
2587. J. Robertson, St. Ninians, Stirling, N.B.—Imp. in musical instruments.
2589. E. Mellor, Rochdale, Lancashire—Imp. in mules and other machinery for spinning cotton and other fibrous substances, whereby the cop will be built much firmer, and prevent snarls in the yarn.
2591. J. Brennand, Manchester—An imp. in ploughs, and in other agricultural implements, and in the method of driving the same.
2593. S. Wheatcroft, Brudenell-place, New North-road—Improved apparatus for uniting lace to blonde and other fabrics.
2595. W. Clark, Chancery-lane—A process of thickening, strengthening, and improving tanned hides. (A com.)
2587. W. Clark, Chancery-lane—An improved bit or bridle for horses. (A com.)

[From Gazette, December 3, 1858.]

Dated 17*th September*, 1858.

2102. C. Hadley, Lower Hurst-street, Birmingham—Imp. in omnibuses, cabs, railway carriages, waggons, and other similar vehicles.

Dated 6*th November*, 1858.

2483 A. Fryer, Manchester—An improved method of supplying the tenders of locomotive engines, and of supplying boilers with water.
2484. W. Green, 21, King William-street, Strand—An improved harness trace coupling. (A com.)
2486. Baron D. Webster, Penns, Warwickshire, and J. Horsfall, Birmingham—An imp. in the manutacure of steel wire.
2488. M. Matley, H. Miller, and T. Hall, Ashton under-Lyne—Imp. in the construction and arrangement of steam boilers and furnaces, for the purpose of consuming smoke, economizing fuel, and heating the feed water, and also imps. in certain valves connected with steam boilers.
2490. 7. Platt, Oldham—Imp. in machinery or apparatus for preparing, spinning, and doubling cotton and other fibrous materials.

Dated 8*th November*, 1858.

2492. M. Osborne, Birmingham—A new or improved method of ornamenting fenders, stove grates, tables, chairs, and couches made of cast-iron.
2954. A. H. Dendy, 27, Fortess-terrace, Kentish-town—Imp. in the construction of breakwaters or wave screens, applicable also in constructing bridges, roadways, piers, jetties, landing-stages, and other structures.
2496. T. MacSweney, 25, Rood-lane—Imp. in steering apparatus.
2498. W. Smith, Little Woolstone, Buckinghamshire—Imp. in apparatus for supporting the hauling ropes when hauling ploughs and other agricultural implements by steam power.
2500. W. C. Cambridge, Bristol—An improved manufacture of tubular iron, applicable to the construction of whippletrees, and to other uses.

Dated 9*th November*, 1858.

2504. J. E. Dickson, 6, Russel-street, Litchurch, near Derby—Imp. in the construction of railway chairs and other details connected with the permanent way of railways.
2508. J. Felix, 54, Rue Croix Nivert, at Grenelle, near Paris—Imp. in castors for furniture and other similar purposes.
2510. W Clark, 53, Chancery-lane—Imp. in signals for railways and in apparatus for actuating the same. (A com.)
2512. V. Newton, 66, Chancery-lane—Imp. in the construction of stairs. (A com.)
2514. V. Newton, 66, Chancery-lane—Certain imp. in electric telegraphs. (A com.)
2516. R. M. Ordish, Great George-street, Westminster—Imp. in constructing the permanent way of railways.

Dated 10*th November*, 1858.

2520. W. Taylor, Ashby-de-la-Zouch, Leicestershire—Imp. in removing the fur from skins and preparing said skins for tanning.
2522. E. Humphrys, Deptford—Imp. in steam engines and boilers.
2524. A. J. Brooks, Southsea—An imp. in screw propellers.
2526. E. Locke, Newport, Monmouthshire—Imp. in the construction of gas meters.

Dated 11*th November*, 1858.

2528. J. Blethyn, Swansea—Imp. in the manufacture of fuel.
2530. R. Wright, Openshaw, near Manchester, and T. J. Mercer, jun., Coventry—A new or improved motive-power engine.
2532. M. Benson, Newcastle—An improved manufacture of rails for railways. (A com.)
2533. T. Gray, Bride-lane—An imp. in separating wool and animal fibres from vegetable fibres contained in mixed fabrics.
2536. A. Mickelthwaite, Sheffield—Imp. in treating and manufacturing buffalo and other horn, so as to be used as a substitute for whalebone and for other useful purposes.

Dated 12*th November*, 1858.

2538. T. F. Cocker Sheffield—Imp. in the manufacture of steel and iron wire, also of sheets and strips of steel.
2542. G. T. Bousfield, Loughborough-park, Brixton—An improved apparatus for illustrating conic sections and the lines of the globe. (A com.)

Dated 13*th November*, 1858.

2544. J. Benyon and J. W. B. Bowden, Swinton, near Manchester—Certain imp. in looms for weaving.
2546. W. Ashton and T. Cartmell—Imp. in air pumps, part of which improvement is also applicable to the pistons of other pumps and of steam engines.
2556. M. Swan, Henstridge-villas, St. John's-wood—Imp. in the construction of floating docks and other floating structures.
2552. I. Livermore, 5, Shrubland-grove, East Queen's-road, Dalston—An imp. in the manufacture of shuttlecocks.
2554. C. J. Thomas, T. Thomas, H. Thomas, and C. Thomas, Bristol—An imp. in the manufacture of caustic alkaline lees.
2556. D. Frodsham, Rose-cottage, Gurney-road, Stratford—Imp. in apparatus used in combination with fire boxes of tubular steam boiler in order to supply air and steam thereto.
2558. J. A. Hopkinson, Huddersfield—Imp. in steam boilers.

Dated 15*th November*, 1858.

2562. G. Davies, 1 Serle-street, Lincoln's-inn—Imp. in the process of finishing piled fabrics, and in apparatus employed in such process. (A com.)
2564 W. G. Armstrong, Newcastle-upon-Tyne—Imp. in the manufacture of ordnance.
2566. W. Clark, 53, Chancery-lane—Imp. in colouring, preserving, and dessicating wood and marble, and in apparatus for the same. (A com.)
2568. J. G. Bunting, Trafalgar-square, Charing-cross—A mechanical horse-tamer or brake.

Dated 16*th November*, 1858.

1570. J. H. Johnson, 47 Lincoln's-inn-fields—Imp. in machinery or apparatus for kneading dough or working and mixing plastic materials. (A com.)
2574. S. Taylor, Temple—Imp. in fountain pens.
2578. A. M. Bruere, Paris—The novel application of hydrogen gas to various purposes in the arts.

Dated 17th November, 1858.

2580. S. Hoga, 14, Nassau-street, W. P. Pigott, 16, Argyll-street, Regent-street, and S. Beardmore, 37, Upper Berkeley street West—Imp. in electric telegraphs.
2582. C. F. Vasserot, 45 Essex-street, Strand—A waterproof coating. (A com.)
2584. T. J. H. Tuck, Great George-street, Westminster—Imp. in the mode of laying and securing telegraphic cables, and in apparatus for the same, and for carrying on other operations under water.
2590. M. Caton, Preston—Imp. in the treading motion of looms for weaving, and also in shuttle boxes and swells connected therewith.
2592. R. A. Brooman, 166, Fleet-street—Imp. in apparatus for the manufacture of lace and net. (A com.)
2594. J. Platt, Oldham, and H. Chubb, Brecknock-crescent, Camden town—Imp. in machinery or apparatus for making bricks or tiles. (A com.)
2596. H. Douglas, Bart., Green-street, Grosvenor-square—Imp. in screw propellers.

Dated 18th November, 1858.

2598. S. Riley, Oldham—Imp. in the manufacture of hats, bonnets, and caps.
2599. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in assorting and separating combed fibres, and in machinery for that purpose. (A com.)
2600. E. Briollet, 58, Torrington-square—The obtaining of caloric by a new chemical and mechanical process. (A com.)
2601. Sir C. T. Bright, Harrow Weald, Middlesex—Imp. in insulators, and an improved mode of connecting insulators to posts and other supports.
2602. J. and H. Sharp, Bradford—Imp. in Jacquard machines employed in weaving.
2603. H. Stott, Greetland, near Halifax—Imp. in warping mills or apparatus connected therewith.
2604. J. Leslie, Conduit-street, Hanover-square—Imp. in the manufacture of gas.
2605. J. Oakes, Exeter-row, Birmingham—Imp. in the manufacture of spurs.
2606. J. M. Miller and J. Fear, Barnstaple—Imp. in machinery for winding fibrous substances or materials when in the form of thread or yarn on to the bobbins or wheels used in lace machinery.
2607. D. Stoten, Ponders End, Middlesex—Imp. in ploughshares.
2608. E. T. Archer, Bridgefield House, Wandsworth—Imp. in hat ventilators, and for appliances connected therewith.
2909. B. Rider, 61, Red Cross-street, Borough—Imp. in ventilating hats and caps, and in the preparation or manufacture of the material of which those articles are made.

Dated 19th November, 1858.

2611. J. Brown, Bolton-le-Moors—Certain imp. in index and Jacquard machines.
2613. G. Howe and J. Norton, Sheffield—An improved method of boiling water or warts for breweries, distilleries, &c., by steam, or for heating rooms, public buildings, churches, chapels, factories, &c.
2617. J. Edwards, 77, Aldermanbury—Imp. in the manufacture of trowser buttons.
2617. C. F. Vasserot, 45, Essex-street, Strand—An improved apparatus for condensing and cooling vapours and liquids. (A com.)
2619. W. Ramscar and J. G. Scott, Manchester—Imp. in fire-arms.
2621. H. Bailey, 35, Golden-square—Imp. in heating razors.
2623. A. Felton, 184, Brick-lane, Spitalfields—Imp. in fastening buttons and studs to dress and other articles.
2625. W. Marshall, Leith Walk, Mid-Lothian, N.B.—Imp. in steam-engines.
2627. A. J. Thorman, 8, Lime-street, City—Imp. in chain cables and chains.
2629. A. V. Newton, 66, Chancery-lane—Improved apparatus for transmitting motive power. (A com.)

Dated 20th November, 1858.

2631. R. Warry, Chatham—Loading cannon at the breech.
2633. C. F. Vasserot, 45, Essex-street, Strand—Imp. in fire-arms and ordnance, and in projectiles to be used therewith. (A com.)
2635. H. Ellis, Holbeach, Lincolnshire—Imp. in machinery or apparatus for cultivating, cleaning, and pulverizing land.
2637. C. Cuit, Paris—Imp. in railway brakes.
2639. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of dolls, statuettes, figures of animals, and others, and toys. (A com.)
2641. D. Evans, Chobham-cottages, New-town, Stratford—Imp. in tubular steam boilers and fire-places, or furnaces used therewith.
2643. J. Young, Wolverhampton—Imp. in fastenings for window sashes and casements, and in chain used for suspending window sashes.
2645. H. Boden, Crescent-cottage, Cambridge-heath, Hackney, and T. Cooper, Ann's-place, Hackney-road—Imp. in plaiting or braiding machinery.

Dated 22nd November, 2858.

2647. C. H. Mellor, Oldham—An improved manufacture of woven fabrics.
2649. F. A. Theroulde, 67, Rue Caumartin, Paris—Imp. in obtaining salts and products from the ashes of marine plants.
2651. A. V. Newton, 66, Chancery-lane—Improved apparatus for propelling and steering vessels. (A com.)
2653. T. Spencer—Imp. in the manufacture or construction of springs.

Invention with Complete Specifications Filed.

2675. J. Luis, 1B, Welbeck-street, Cavendish-square—A safe guard against burglars. (A com.)—25th November, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Nov.* 26, 1858.]

November 25th.
1182. W. Bayliss.
1186. S. C. Lister and J. Warburton.
1188. F. Bouquié.
1207. E. Bond.
1210. W. Hodgson and H. Hodgson.
1215. M. A. F. Mennons.
1220. J. Barker Thornber.
1240. H. Brown, B. Hodgson, and J. Carter.
1270. R. Orr.
1283. J. B. A. Lombard and X. T. Esquiron.
1290. W. Clark.
1292. J. Bunnett.
1349. L. C. S. Masson and F. de la Morinière.
1400. W. E. Newton.
1404. H. Deacon.
1495. S. Lees.
1778. J. Luis.
2079. C. J. Redpath.
2128. F. F. Emery.
2149. W. Richards.
2183. J. J. Russell.
2265. A. von Schuttenbach.

[*From Gazette, Nov.* 30, 1858.]

November 30th.
1232. R. W. Chandler and T. Oliver.
1245. R. Owen.
1246. W. Clayton and J. Goodfellow.
1247. J. Bethell.
1252. R. Owen.
1253. H. Edwards.
1271. A. Manbré.
1275. G. Hadfield.
1351. G. Adshead.
1383. S. Hewitt.
1398. W. C. Wilkins.
1449. W.H. Preece & J. L. Clark.
1459. W. E. Newton.
1485. F. Richmond & H. Chandler
1509. J. Hodgkinson.
1643. E. Hardon.
1681. C. De Jongh.
1765. C. De Jongh.
2053. J. P. Koenig.
2117. T. Cook.

[*From Gazette, Dec.* 3, 1858.]

December 3rd.
1248. T. Scholefield.
1254. T. Wilson.
1268. C. Hancock.
1277. J. Ferrabee.
1282. E. Vigers.
1284. R. Hicks.
1307. H. Rollinson.
1336. W. Clark.
1338. W. Clark.
1442. W. E. Newton.
1450. C. Erhard.
2067. R. Frost and A. Rigg.
9144. E. T. Wright.
2182. G. Uhlhorn.
2198. B. Samuelson.
2206. S. Stimpson.

[*From Gazette, Dec.* 7, 1858.]

December 7th.
1978. J. J. Rowley.
1280. J. M. Dunlop.
1281. H. Wimball.
1285. J. M. Dunlop.
1288. J. C. Quince.
1301. E. C. Grimshaw.
1304. J. Easterbrook.
1305. P. Dumont.
1308. T. Robinson and H. Ogden.
1319. J. S. Crosland.
1321. G. Hall.
1322. H. Reynolds.
1330. S. Cheavin.
1335. J. Hall.
1350. B. Pitt.
1368. T. Steven.
1407. W. and J. Galloway.
1489. W. Sellers.
1511. M. Nelson.
1514. J. Dodd and T. Phillips.
1665. H. J. Giffard.
1743. G. S. Hill.
1772. W. Clay.
1853. J. H. Johnson.
1883. R. Anderson.
2134. J. Spence.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Nov.* 26, 1858.]

November 23rd.
2657. J. Wilkes.
2667. W. E. Newton.
2699. P. L. Bergeon.
2705. E. J. Davis.

[*From Gazette, Nov.* 30, 1858.]

November 25th.
2662. G. E. Dering.
2676. J. H. Johnson.
2745. A. Paget.
November 27th.
2687. R. A. Brooman.

[*From Gazette, Dec.* 3, 1857.]

November 29th.
2706. S. C. Lister.
November 30th.
2708. W. Ward.
2719. W. Rowan.

[*From Gazette, Dec.* 7, 1858.]

December 3rd.
2727. J. Barling.
2594. J. Murdoch.
December 4th.
2732. J. Moffat.
2735. T. M. Fell.
2751. T. Chaffer and J. Ellis.
2753. R. Bodmer.
2756. F. S. Thomas and W. E. Tilley.

Journal of the Society of Arts.

FRIDAY, DECEMBER 17, 1858.

EXHIBITION OF 1861.

The following letter has been addressed to the Foreign Exhibitors in 1851:—

Society for the Encouragement of Arts,
Manufactures, and Commerce.
Adelphi, London, W.C., 8th December, 1858.

Sir,—The Council of this Society have had under their consideration the desirableness of holding in London, in the year 1861, another International Exhibition of Industry. The Exhibition of 1851 having originated with this Society, gives it a peculiar claim to interest itself in the promotion of such displays in future. The Council of this Society have passed the resolutions* a copy of which I have the honour to enclose.

Previous to the year 1851, National Exhibitions had been held in other countries, but England was the first to try, in that year, the novel experiment of a great International Exhibition, which is admitted on all hands to have been eminently successful, and to have conferred great benefits on the industrial world at large. The Council believe that the manufacturers of this country are ready to support another Exhibition in 1861; but whilst the Council are employed in considering the best means of carrying it into effect, they are desirous of learning how far they may reckon on the support of foreign contributors.

Although it may be premature at the present time to issue definite invitations to manufacturers and others to exhibit in 1861, yet the plan has so far advanced as to render it desirable that early notice should be at once given to the public, both in foreign countries and at home, of the views and intentions of the Council; and I am directed to ask if the Council may hope to see your name in the list of exhibitors in 1861, as it was in 1851. I have the honour to be, Sir,

Your obedient servant,
P. LE NEVE FOSTER, Secretary.

FIFTH ORDINARY MEETING.

Wednesday, Dec. 15, 1858.

The Fifth Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 15th inst., Admiral Sir Charles Napier, K.C.B., M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Lye, Charles Frederick	Poncia, Frederick Theodore

The Paper read was—

ON THE MODIFICATIONS WHICH THE SHIPS OF THE ROYAL NAVY HAVE UNDERGONE DURING THE PRESENT CENTURY IN RESPECT OF DIMENSIONS, FORMS, MEANS OF PROPULSION, AND POWERS OF ATTACK AND DEFENCE.

By E. J. Reed.

The science of naval architecture was so greatly advanced on the Continent, and so much neglected in England, during the last century, that the forms, dimensions, and speeds of the ships of the British Navy were, for the most part, inferior, class for class, to those of every other nation with the ships of which we had to cope. The only mode of improvement which the naval authorities of that period countenanced, was that of imitating the forms of such captured vessels as were deemed superior to our own; and, therefore, as "imitation cannot go above its model," the attainment of excellence was not possible. Full advantage was not taken even of the imitative system, imperfect as it was; for, whenever the form of a foreign model of any given class was copied, the dimensions—and therefore the power of carrying weight and sail—were invariably reduced, and many of the best qualities of the vessel thus sacrificed. Throughout all the wars waged by England during the eighteenth century—with France, Spain, Holland, and America—the genius of our admirals had continually to struggle with the great evil of overburdened ships. Whenever a British man-of-war fell into the hands of the enemy, her armament was forthwith diminished, and her efficiency thus improved, as was frequently discovered on the recapture of our own ships. The evil was, however, but little regarded by successive naval administrations, and prevailed even to the end of Lord Nelson's career, diminishing the extent, though not the splendour, of those victories with which he glorified the dawn of the present century. Happily for us, and for those colonies and states whose liberties depend upon our naval supremacy, the tactics of our admirals, and the bravery of our men, won for us much more than we lost by the inferiority of our vessels. Happily, also, that inferiority no longer exists. The ships of our navy have not only ceased to be imitations, but have become the models for the navies of the world, and I have now to trace the progress of the great changes which they have undergone—changes which embrace not minor variations merely, but entire and unprecedented transformations, consequent mainly upon the introduction of steam. In doing this, I shall not enter into those details of practical construction which concern the shipbuilder only, and not the commander, my object being to record those modifications of dimensions, forms, means of propulsion, and powers of attack and defence, upon which the value of our ships as engines of war more immediately depends.

It has already been stated that our vessels of war were much inferior in size fifty years ago to the vessels of foreign navies carrying like armaments. In the war which the United States declared against us in 1812, our inferiority was disastrously demonstrated. The large frigates with which the Americans assailed our fleets stationed on their coast, were too powerful to be successfully resisted. For their superiority was not confined to size alone; their armaments likewise greatly exceeded ours in vessels nominally of the same class, the English ships carrying many light carronades that counted as cannon, and the American being sometimes armed with guns 50 per cent. greater in number than they were supposed to bear. The result was that many a British flag was struck after a hard-fought battle, and the star of our supremacy, which had burned so brilliantly since the days of Blake and the admirals of the Commonwealth, seemed to sink in the western waters. This fact so far stirred our naval authorities as to induce them to build new vessels of uncommon size, and to razée, or cut down, several two-decked ships and arm them as large class frigates. Even then, however, the vicious practice of keeping the dimensions of our vessels below those of their antagonists was by no means rooted out. On the contrary, the American cruisers were permitted to retain an unquestionable superiority in their sailing powers, their armaments, and the numbers of their crews. Then, however, as before—and may I not say since?—the mistakes of our administrators were atoned for by the courage of our men; and Captain Broke and his gallant companions in the *Shannon* captured the formidable *Chesapeake*, and restored our national prestige.

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* See *Journal*, Vol. VI., p. 333.

When the conclusion of the wars with America and France, and the successful expedition to Algiers, had left us without notable enemies, leisure was afforded for the consideration of such improvements as experience had shown to be desirable. Sir Robert Seppings, the Surveyor of the Navy, and the introducer of several important improvements in the frames and other portions of the fabrics of ships of war, effected great changes in their bows and sterns. After the Battle of Trafalgar, the *Victory* was repaired at Chatham Dockyard, of which Sir Robert was then master shipwright; and in surveying her he observed that she had suffered much on the upper or main deck, when bearing down on the enemy at the commencement of the action, in consequence of the grape shot penetrating the thin transverse beak-head partition then in fashion, which was without the ordinary timbering. It was perfectly evident, he said, that had the ship been formed with a regular and solidly-built bow, many a life would have been saved. This was fully acknowledged by Captain Hardy, and after a short period the strong circular or curved bow now in use, which is framed and planked like the rest of the ship, was introduced. This bow is attended by additional advantages—including the use of bow guns, an increase of strength, and others which I cannot stay to mention. Sir Robert contended, I believe, that he was the first inventor of round bows. But that famous old ship, the *Royal Sovereign*, which Charles I. built with his fatal ship-money, and which Cromwell so vigorously availed himself of, notwithstanding her origin, undoubtedly had a round bow, as an ancient drawing now in the model room of Somerset House plainly evidences. This fact, however, in no way detracts from the great merit of Sir Robert's improvements.

Sir Robert next turned his attention to the sterns of vessels; and here he considered a similar change necessary, to improve the defence of the vessel, to increase her strength, and to enable her to fight her stern guns with greater advantage. It was objected by some opponents of Sir Robert that the evils he believed to exist were not real—that sterns were not weak—that their fighting capabilities did not need improvement—that we had no need of stern guns in our navy at all, as we always fought and never ran—and that by improving our sterns we should only be teaching our enemies, who did run, how to arm theirs. All these objections were repeated in 1828, by the gallant admiral, Sir Charles Napier, in a letter addressed by him to the *Naval and Military Gazette*, and signed "A Post Captain." It is difficult, however, to admit the validity of such statements. I consider the whole of them more than answered in an able letter, addressed by Sir Robert Seppings in 1822, to Viscount Melville, the First Lord of the Admiralty. Sir Robert there states facts which the most dashing Napierian sentences cannot destroy. The circular sterns were, however, undoubtedly attended by one great fault, which Sir Charles Napier pointed out in the following paragraph of the letter just referred to:—"In the first place," he says, "the rudder is too much exposed. In the second place, the ship is deprived of her counter, which I have always considered a very necessary part of her, and which one would suppose the very derivation of the word from the French word *contre* sufficiently proves the utility of. I apprehend without that projection the sea would come in at the cabin windows; and, lastly, the whole of the gingerbread outside of the ship would be blown away when the guns were much used." The first of these objections is, doubtless, perfectly valid, and the last not without reason. The second however is not well founded. It is not possible that the use of a certain word by the French can "prove" the utility of a ship's counter. It may indicate the opinion of the French upon the point, but it can do no more. Further, it is evident that the low projecting counter of a ship may receive shocks from waves which would never climb to the cabin windows. The round stern was, however, attended by another defect, which, together with the exposure of the rudder, led to its abandonment, and to the adoption of its main features in a modified form. This defect was the heavy and ungraceful appearance which all agree in attributing to it. The attainment of beauty is not certainly the primary object in the construction of vessels of war, nor can the aim of their designers be that of gratifying the exquisite taste of the poet laureate, as from his Isle of Wight residence he sees

> "Below the milky steep
> Some ship of battle slowly creep,
> And on thro' zones of light and shadow
> Glimmer away to the lonely deep."

On the contrary, if there were on earth any object in which an utter want of beauty might be deemed tolerable, it would be, I presume, a ship of war—a thing conceived and built for battle, filled with compact fires, and commissioned to thunder forth deadly destinies. But beauty is never unbecoming; we look for it even in a war-ship, and the elliptical stern which has succeeded the circular stern, eminently possesses it. The design of this stern, which permitted the builder to afford increased protection to the stern-post, and which is now adopted in all new ships of war, was claimed by each of three late master shipwrights—Mr. Lang, Mr. Blake, and Mr. Roberts. It was introduced under the auspices of Sir W. Symonds, and in the form which is now given to it by Sir Baldwin Walker, the present Surveyor of the Navy, is a truly admirable combination of beauty and utility. The principal curves visible in it harmonize so well with the sheer lines of the ship, that she appears to float lightly and easily upon the water, whereas the circular Seppings' stern, with its obtrusive stern post, made the spectator feel not only that much of the ship was submerged, as it in fact was, but also that the submersion of the whole of her was imminent. There is of course no power in the ugliest vessel to sink deeper than the laws of hydrostatics will allow her; but it is not pleasant to have to correct an impression of art by reference to a fact of science.

It was intended that with the improved bows and sterns the foreward and the right aft guns might be fired in the direction of the keel—that is, be brought to bear upon an enemy immediately in front or rear of the ship, and that the fires of every two adjacent guns from bow to stern might cross each other within easy range, so that the ship should have the power of defending herself, and of attacking an enemy in every direction with two guns at least. Great difficulty was, however, often experienced in getting the bow chase guns to run out far enough to prevent injury to the ship on the discharge of the gun, for it is by no means an easy matter to make a vessel sufficiently bluff for that purpose on the deck line, and at the same time to keep her fine at the load water line. This difficulty has recently been evaded by the adoption of a pivot gun raised above the fixed bow of the vessel, and capable of being turned upon shifting centres at one end, and of running on circular or segmental plates at the other. This gun commands the entire sweep of the bow, and, being usually of large calibre and long range, is admirably adapted for chasing. Its introduction into the service was a very notable improvement. The pivot gun is usually a 68-pounder, sometimes a 10-inch shell gun; and it is fitted in all our first rate steam line-of-battle ships, and most other steam ships of war, including second and third rates, frigates, corvettes, and many scores of our steam gun boats. In several classes of ships a second pivot gun, of like size, is fitted at the stern. All our steam block ships are thus fitted, as are also the whole of our screw steam gun vessels, numbering, according to the current number of the "Navy List," twenty-six. It is difficult to believe, however, that we are acting wisely in accepting the bow pivot gun as a sufficient substitute for the bow chase guns on the fighting decks of our screw line-of-battle ships, as I observe we have done in some modern examples. The pivot gun is an exposed gun, and is liable to be disabled in action; it cannot therefore be prudent to depend, in a large ship, upon it alone for our power in chasing, and to deprive ourselves of the means of firing a single shot directly in advance, should that one gun be injured. I am fully aware that by running this risk, fine lines may be given to the vessel, but this advantage is not worth the risk, as I fear we shall prove in the event of a naval war if we pursue the new system.

Still more interesting changes were introduced by the successor of Sir Robert Seppings, at which I have now to glance. In the year 1819, Lieutenant William Symonds, an officer of 25 years' standing in the service, was appointed Intendant of Marine Police, and captain of the Port of Malta, and, being of an inventive turn of mind, there took to yacht building. For the knowledge of this fact I am indebted to a poem of his, in which he says,—

> "In Malta I first took to naval construction,
> In Malta I launched forth my maiden production."

I have elsewhere sketched the progress of Lieutenant Symonds from this period of his career as briefly as I was able, and I request permission to repeat here what I there wrote. "His maiden production was the *Nancy Dawson*, and he tells us that 'When the Hon. G. Vernon and his lady came to the island for her health, in their yacht, the *Transit*, I was introduced to them by more than one person, and we soon became very well acquainted. I made my first trial of the *Nancy Dawson's* sailing against his yacht, and had so considerable advantage that I was led to believe that I had hit upon a secret in naval architecture; and after trying my hand upon four or five others of a smaller description, which answered beyond my warmest expectations, I was confirmed in the success of my principles by these experiments. Great breadth of beam and extraordinary sharpness' (—sharpness of what?) 'are the characteristic features of my system, with a careful attention to stowage, the stand of the masts, and the cut and setting of the sails; nor had I, in any instance, occasion to alter anything materially from my first idea. The consequence was, a firm conviction that I might attempt something on a larger scale, with every hope of success.' Upon this most slender basis was the whole fabric of Sir William's subsequent career built. The yacht gained him the notice of noblemen and others; then followed a pamphlet on naval architecture (in which the defects of many existing ships were pointed out, and great breadth of beam and rise of floor were advocated); then came a promise from the First Lord of the Admiralty, Lord Melville (obtained through the influence of Lord Lauderdale), that he should build a sloop of war on his plans, which he did, the vessel being called the *Columbine* (promotion intervening;) then further patronage from the Duke of Portland, and the Duke of Clarence, the latter of whom, when he became Lord High admiral, ordered him to lay down a 40-gun frigate (promotion again intervening); then the building of the *Pantaloon*, 10-gun brig, for the Duke of Portland, from whom the Admiralty purchased her; then the patronage of that most mischievous civilian First Lord, Sir J. Graham; then the order for the *Vernon*, 50-gun frigate; and then, in 1832, the Surveyorship of the Navy!" *

The characteristic features of Sir William's designs for ships were, as we have seen, great breadth of beam at and above the water line, and great sharpness of floor.

I have not space here to discuss the merits and demerits of the characteristic qualities of the ships of Sir William Symonds, or to revive the prolonged and bitter controversies to which his elevation gave rise. Sir William was essentially an amateur ship-builder, and the Lords of the Admiralty (influenced mainly by Sir James Graham) by investing him with supreme control of the Surveyor of the Navy's department, made war not only upon professional naval architects, but upon the profession of naval architecture itself. The consequence was that ship-building officers, both of the old tentative school and of the new scientific school, which latter had lately been called into existence by their lordships, strenuously resisted Sir William's innovations; but as he was supported by powerful friends, and had a large amount of patronage in his own hands, while his opponents were, almost without exception, his subordinates, I need not say who for the time triumphed. It should be observed, however, that the principles of construction for which Messrs. Read, Chatfield, Creuze, and others trained in the school of naval architecture contended, are to a great extent predominant at the present day in the Royal service, while not a single feature of Sir William Symonds' system of construction is retained,* except certain practical improvements which he made in the actual building of ships, and which deserve to be mentioned with the utmost favour. Still his services as a naval constructor were not without value to the country. He was the first who proved successful in breaking down and abolishing that vicious system of restricting constructors to certain arbitrary dimensions to which I have before referred, and in which the Admiralty persisted until his time. This was no small service. He also brought into his department an energy which filled it with vigour, and prepared the way for those sound and scientific changes which his more temperate successor has promoted with equal zeal and superior judgment.

Had Sir W. Symonds lived a century earlier, his career might have closed in brightness and triumph; but, coming when he came, he had scarcely raised himself to his high office before he began to feel his schemes and crotchets baffled by a power whose marvellous progress no devices of man can withstand. The all-changing irresistible power of steam, against the mastery of which so many have vainly mutinied, began to make itself felt in the Royal Navy even before Sir William commenced experimenting at Malta. In 1815, Lord Melville ordered an engine to be built for the sloop of war *Congo*, and, although that vessel was not fitted with it, the design of propelling ships of war by steam was not abandoned. In 1821, the *Monkey*—a vessel which is still, I believe, doing duty at Woolwich—was purchased by the Admiralty, and her name is likely to become memorable as that of the first steamer the Royal Navy possessed. Her purchase was followed by the building of the *Comet* at Deptford dockyard, under the direction of the late Oliver Lang, Esq. Other vessels succeeded rapidly, some designed by Sir Robert Seppings, others by the master shipwrights of the dockyards, and others by private builders. All were, of course, for many years fitted with paddle wheels. Ultimately, in the year 1832, Sir William Symonds had the designing of steam, as well as all other vessels for H.M. Service, committed to him as Surveyor of the Navy.

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* *Mechanics Magazine.* Vol. 68, No. 1812, p. 413.

* As an example I may refer to the forms of midship section advocated respectively by him and by them. Sir William's great principle—or rather Sir William's great crotchet—was the sharpening the floor of the ship, at the same time carrying her greatest breadth considerably above the load-water line. The latter he deemed essential to stability. The members of the School of Naval Architecture, on the contrary, pointed out that, by making her sharp of floor, and broader above the water-line than at it, the ship, when inclined by the wind, by tending to immerse more of herself on one side than emerged on the other, would be moved bodily upwards, and thus subjected to vertical motions, more or less violent, which would tend to the injury of her fabric and the discomfort of her officers and men. They, therefore, recommended that the midship portion of the side of the ship should be either vertical, or similarly inclined immediately above and below the water-line, and considered that nothing better than a side vertical between wind and water could be chosen for a ship of war. I have only to add, on this point, that all new ships of war now have the full floors and vertical sides which they recommended. Thus, on two points of the very first importance, Sir William's ideas have been discredited, and the same may be said, with equal truth, in respect to his third doctrine—that of the necessity of giving great depth of beam in proportion to length. The proportion is less now than ever. E. J. R.

Nothing more unpropitious for Sir William's mode of construction than the introduction of steam can be conceived. His sharp bottoms were the very worst possible for the reception of engines; his broad beam and short length the most unfavourable qualities that could be devised for steam propulsion. As much as he could he adhered to his principles, and, although compelled by sheer necessity to adopt an increase of length and a greater fullness below water, he changed his plans as little as possible. Rather than yield to the demands of the new power, he sacrificed the armaments of his vessels, kept down the size of their engines, and recklessly exposed the machinery to shot should they go into action. To his lasting honour, Sir Charles Napier exposed and fought earnestly against these great evils; not with any immediate success, it is true, but the introduction of steamers with guns upon the main deck was mainly the result of his just, persistant, and courageous denunciations of the system under which the expense of large vessels and costly engines was incurred with no better result than that of bearing half-a-dozen guns about.

In the year 1837, Captain Ericsson made a very favourable run down the Thames in a steam vessel fitted with his patent screw propeller, having the Lords of the Admiralty and Sir. W. Symonds on board. Notwithstanding the success of the experiment, and the manifest advantages of a submerged propeller for a ship of war, Sir William made no sign in favour of the new instrument. Captain Ericsson, therefore, took it to the United States, where it was speedily introduced into the war navy of America. Three years afterwards, in 1840, the *Archimedes*, fitted with Mr. Smith's patent screw propeller, made many highly successful trial trips, which were reported to the Admiralty by officers of their own. After further opposition and a further delay of years, the *Rattler*, a ship of war, was adapted at Sheerness to receive a screw propeller, and after numerous experiments with screws of different forms, the two-bladed screw now exhibited at the Patent Museum, South Kensington, was finally adopted as the best that could be devised. In 1845, the *Rattler* was tested in comparison with the *Alecto*, a paddle-wheel vessel of similar form, size, and steam-power, and the test still further established the superiority of the screw. The *Rattler* was by chance built with a particularly fine run aft; but as this was not known to be essential, other screw steamers were commenced with a greater fullness near the stern. The access of the water to the propeller would thus have been seriously interfered with, but Mr. Lloyd, now the chief engineer and inspector of machinery in the steam branch of the Surveyor of the Navy's office, very wisely foresaw the evil, and induced the Admiralty to take the necessary steps for its prevention. Since 1846, the building of screw ships has become so general, that not only has the paddle-wheel been altogether superseded in all newly-built fighting vessels, but there is not even a single ship unprovided with a screw now on the stocks. Every ship now built is fitted with that steam-driven submerged propeller, the introduction of which, the late surveyor of our navy, only 11 years since, was obstinately resisting, and had obstinately resisted for 11 years previous. Surely the policy of placing it in the power of one prejudiced man to prohibit the nation for many years from rendering its greatest scientific achievement available in its own defence, when other nations were extensively adopting it, is deserving of nothing but unmitigated reprobation.

Admiral Sir Charles Napier, to whom I have had occasion already to make frequent reference, was among the very first to apply iron as a material for constructing steam-vessels. With Sir Charles Napier was associated Mr. Charles Manby, the much respected secretary of a contemporary professional institution. Together these gentlemen formed a society, and built the first iron steam vessel, the *Aaron Manby*, which Sir Charles took charge of, and navigated to Paris. Other vessels followed; but for their history I must refer you to Mr. Grantham's admirable volume on "Iron Shipbuilding," in which their progress is traced from the earliest example up to that magnificent vessel to which the London public are now thronging, and which, by her excellence of design and her strength of structure, even more than by her immense magnitude, excites the astonishment and admiration of all intelligent beholders.

In 1842 Mr. Belmano, of New York, addressed a letter to the Earl of Aberdeen, alleging that plates of iron $\frac{3}{8}$ths of an inch thick had been rivetted together to a thickness of six inches, and then found to be ball-proof. Sir Thomas Hasting, of H.M. gunnery ship *Excellent*, was instructed to discover if they were so. After making the experiment, he reported that such a combination of plates fixed over the planking of a ship's side would give no protection at two hundred yards against shot fired with 10lbs. charges of powder from 8 inch guns and heavy 32-pounders.

In 1843, however, the Admiralty commenced building iron ships of war, and in three years built and purchased 18 such vessels (besides several others not intended to carry armament), at a cost of £420,000, and £260,000 additional for engines—in all about £680,000. I can offer no reason for this sudden and unexpected movement, which, as I hardly need say, ended in failure. It may have been the result of a well-meant, but ill-advised, attempt to give a rapid expansion to the power of the Royal Navy, or it may have been due to the secret influences brought to bear on some member or members of the Board of Amiralty by interested parties. But of that ingenious and complicated system of wheels within wheels by which our public departments are often worked, I cannot presume to speak. Like millions of others, I know but little save of that one great wheel, the outermost of all, which rolls perpetually along the land, whose revolutions never cease, and from whose path but few escape—the colossal and ponderous wheel of national taxation. Of the wheels within, which move *that*, who has any just or adequate knowledge?

In the construction of mercantile vessels iron is superior to wood. Iron ships, as compared with wooden, may be built lighter and stronger, of greater capacity, of superior speed, increased durability, and at a less cost both for purchase and repairs. In Great Britain, moreover, iron is much more abundant than wood, and its manufacture is now becoming improved almost daily. On the other hand, the bottoms of iron ships get rapidly foul, and their hulls, when of moderate thickness, are shattered by the action of shot much more injuriously than the hulls of wooden ships. The first objection is got rid of in merchant vessels, by cleaning their bottoms when they come into port, which they frequently do. The second is, of course, not directly applicable to them. But the rapid fouling of the bottom of a vessel of war, which is often engaged for years together far from all facilities for cleaning her below water, would, at all times, be a highly injurious, and often a fatal evil. The destructive action of shot upon such a vessel, is a still more decided ground of inefficiency. These facts were not considered by the Admiralty in 1843, and when Sir Charles Napier mentioned in the House of Commons the folly of building five or six iron steamers without trying one, the Secretary of the Admiralty exultingly exclaimed, Sir Charles informs us, "We are building forty." They did build, not forty, but eighteen, at a cost, as I have said, of considerably more than half a million.

Experiments were made at Woolwich Arsenal to test whether, if iron were lined with kamptulicon—a mixture of India-rubber, cork, &c.—the holes formed in the fabric by the shot would not be stopped after the shot's passage, by the closing up of the elastic substance. Some advantage was gained in this way, but not sufficient to lead to the adoption of such a combination. In 1846, the *Ruby*, a small vessel, built of thin iron, and in a bad state of repair, was fired at from the *Excellent*, and Captain (now Admiral) Chads, reported that the shot passed clean through the near side of the vessel, but that on the off side the effect was terrific, tearing off the sheets of iron to a very considerable extent. Splinters from the near side were few but severe. These conditions were reversed by subsequent experiments made by Admiral Chads, the near side being found to suffer most in stronger vessels. In July, 1850, after numerous experiments, he finally reported that iron could not be beneficially employed as a material for the construction of vessels of war. Since that time the building of iron ships of war has not been proceeded with.

I come now to the period of the late war with Russia, which, though a military rather than a naval contest, did not fail to exert important influences upon the constitution of the Royal Navy. That war opened, it will be remembered by a Russian attack on a Turkish squadron at Sinope, November 20th, 1853, at a time when Russia had bound itself by a solemn promise to act on the defensive only. The Turkish squadron consisted of 7 frigates, 1 sloop, 2 corvettes, 2 steamers, and 2 transports, supported by five land batteries. The attacking squadron was composed of 6 line-of-battle ships, and 2 frigates, supported by three or four steamers. The latter squadron was well supplied with shell guns, while the Turks had nothing more effective than 24-pounders. The action was speedily decided, by the burning of almost the whole of the Turkish vessels, produced, as the surviving officers stated, exclusively by the shells of the enemy. The only frigate that remained afloat after the action, the *Damietta*, had seventeen shots through her below water, and was therefore burnt. I mention this engagement merely as an early and notable example of the destructive effect of shell guns in naval warfare, the remarkable circumstance being, not that the Turks were beaten—for the Russian force was vastly superior to theirs—but that their whole force of fourteen ships was, to a great extent, silenced in a few minutes, and utterly crushed in little more than an hour.

It has been fashionable, in some quarters, to sneer at the operations of the combined navies of England and France in the Black and the Baltic Seas during the war; but the spectacle of one Russian fleet sunk by Russian hands at Sebastopol, and of another trembling, season after season, behind stone fortresses in the shallow waters of Cronstadt, never daring to accept the challenge of any British squadron, however small, is one the record of which we certainly may read without shame. Still, the fleets of England, though well adapted for battles by sea, and sufficient to drive the enemy from the open waters, were almost totally deficient of the class of vessels which were essential to the putting forth of our full power against his fleets and coasts. Nor was the want supplied with anything like that promptitude which the occasion demanded. It is difficult, with all the facts before us, to believe that the neglect occurred in the naval department. The Government, it will be recollected, was inactive; slow not only in entering upon war—which all governments should be; but slow also in conducting the war after it was entered upon—which no government should be. When they grew vigilant and active, and the Naval Department was called upon to provide light-draught steam vessels without delay, the work was entered upon with astonishing and admirable rapidity. All the capabilities of the royal dockyards were put into instant requisition; the Government steam factories were everywhere expanded, and in some places, such as Sheerness, created; and private builders were called upon to take up large contracts. The execution of these contracts, though performed with the utmost alacrity and good-will, involved the contractors in serious pecuniary losses, which the Surveyor of the Navy exerted himself to mitigate, and did mitigate to some extent. This evil was, I grieve to say, greatly aggravated, if not altogether occasioned, by the excessive demands for wages made upon the contractors by their workmen, who knew they were needed, and straightway played the tyrant. As a correspondent of mine truly wrote some months since, "The reminiscence of the Russian war, to those who built the gun-boats, is an exceedingly painful one. Ruin befel one or two of those builders, and all sustained heavy pecuniary loss. The only relieving light it has, is the indelible impression which the urbanity and sympathy of Sir Baldwin Walker evinced, and the appropriateness and beauty of form of the vessels which his immediate assistants designed." The last sentence implies a fact which some have doubted. The "appropriateness and beauty of form" of the new gun-boats, gun-vessels, and despatch vessels have been questioned. No one, however, who has seen the corresponding vessels, built by the French, and who understands *all* the difficulties of combining speed, lightness, sea-worthiness, and a powerful armament in one vessel, will question them. Mr. Scott Russell's paddle-wheel gun vessels, the *Recruit* and *Weser* (formerly the *Nix* and *Salamander*), are in many respects most excellent vessels, and the former proved very valuable in the Sea of Azof. Captain Dahlgren, of the American Navy, mentions her as "highly spoken of, being a fast and an excellent sea-boat;" but the same experienced officer says also of the Admiralty's vessels, "For the service contemplated, this fleet of small screw-vessels was well adapted—far better than any other." Further, Sir Howard Douglas, Bart., the distinguished author of "Naval Gunnery"—to whom the naval service is more indebted than to any other man living or dead for the efficient use of its armaments—published only a fortnight since a treatise on "Naval Warfare," in which, while he complains of the great length of the despatch vessels as a cause of weakness, he adds, "A smaller class of steam-vessels has since been constructed as gun-boats, and these come fully up to the author's idea of what a good gun-boat should be." They possess, however, one great defect in the rapidity with which the tube-plates of their boilers burn out. So great is this evil in the gun-boats, that in the mere trials of the engines the boilers often become so bad as to require extensive repairs.*

The Admiralty have frequently been accused of building line-of-battle ships in profusion, to the neglect of frigates and lighter vessels. If there was some show of reason in this charge at the commencement of the Russian war, since that period there has existed no ground for its repetition. Our navy is now composed of the following fighting vessels:—First, 201 sailing vessels of all classes, but few of which, probably, will ever again be commissioned. (Might not some of these be sold with advantage? Scores of them, which will not be used again as ships of war, would be valuable for many mercantile purposes, and should not, therefore, be permitted to rot in our harbours.) Next, we have 75 paddle-wheel steamers, most of which, though not very effective for fighting purposess will, while they last, be of considerable value in times, of peace, and of some service even in war. Finally, we have a fleet of screw steam-ships and vessels, to the constitution of which I desire to draw particular attention. It consists of 51 line-of-battle ships, each armed with 8-inch shell guns and 32-pounder solid shot guns, in various proportions, together with one, and in some cases two, pivot 68-pounders; 9 block ships, also armed with 8-inch shell-guns, and 32-pounders in various proportions, together with two 68-pounders, and four 10-inch shell-guns to each ship; 28 frigates, most of them powerfully and some them very formidably armed —the engines of 16 of the 28 being at least of 600 nominal horse-power; 13 corvettes, each carrying twenty 8-inch shell-guns, and at least one 68-pounder, or one 10-inch shell-gun; 8 other corvettes, armed with 32-pounders, and at least one pivot-gun each; 4 mortar frigates, with 13-inch mortars, 68-pounders, and 32-pounders; 8 floating batteries, entirely with 68-pounders; 27 sloops, mainly with 32-pounders; 26 gun-vessels, with 68-pounders and 32-pounders; and 163 gun-boats, each with one 68-pounder and one 32-pounder—in all 331, inclusive of a few now building and undergoing alterations. It is impossible to examine these figures without observing that the number of our frigates, corvettes, sloops, and still smaller vessels, is very large as compared with our ships of the line; and it is, in my judgment, equally impossible to point out any very glaring defects in the principle upon which they are armed. This latter statement cannot well be tested otherwise than by a comparative reference to foreign navies. The only two of these to which I need refer are those of France and America. As to the former, I have carefully examined the official records (which are published by Sir Howard Douglas in his Naval Gunnery), and I find no ground whatever for considering that the armaments of French ships of war are in any way superior to our own. With regard to the American navy we have, indeed, heard much that sounds formidable, recently, especially of the *Niagara* and the *Merrimac*. Of the former of those vessels I need say but little, as the American Government itself places small confidence in her. She is, it is true, a gigantic vessel, but she carries only a dozen shell-guns; and our own frigate, *Diadem*, of about two-thirds her size, would, as I have elsewhere shown, speedily overpower her, either at short or at long range. The *Merrimac* is certainly a very formidable vessel. Captain Dahlgren, in a recently published work on "Shells and Shell Guns," draws a careful comparison between her and our own *Shannon*, the name of which will be fresh in every mind, as the last command of the chivalrous and much lamented Sir William Peel. Captain Dahlgren very fairly decides that the *Merrimac* is the more powerful ship of the two; but seeing that, as he admits, her tonnage is one-fifth greater than the *Shannon's*, we might well be astonished if she were not of superior power. We have, however, other vessels similar in size to the *Merrimac*, one class of which is armed entirely with heavy 68-pounders, from which, of course, eight-inch shells can be most effectively fired; and another class armed with a combination of ten-inch shell-guns and 68-pounders of 95 cwt. The vessels of both these classes are fitted with engines of no less than 1,000-horse power, by virtue of which they will probably attain a speed of twelve or fourteen knots per hour, while the *Merrimac* makes eight knots only. The advantages of this superiority of speed I need not dwell upon. Captain Dahlgren has himself since said, in reference to these vessels, "there can be little doubt that with any reasonable success in applying their capabilities they must become the most formidable of ships of war."

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* I have great pleasure in being able to state that Rear Admiral J. Jervis Tucker, and Mr. Blaxland, Superintendent Engineer of the factory at Sheerness Dockyard, have energetically endeavoured to remedy this evil, and have succeeded in getting rid of the troublesome and expensive tubular system altogether. They simply employ a series of several fire-clay bridges within the furnace, in conjunction with means for admitting air, at the same time diminishing the size and increasing the number of the fire places. The system answers perfectly, and not only does away with the derangements and expenses attendant upon the tubular system, but also increases the evaporation, prevents the formation of smoke, greatly economises the fuel (a very important point in marine boilers), and renders the supply of steam to the engine surprisingly uniform. Some delay has occurred in the adoption of these improvements by the Steam Department of the Admiralty, mainly, I believe, in consequence of Captain Halsted and the engineers of the steam reserve at Sheerness having instituted experiments with a modified form of tubular boiler, which appears to me to be either the same as, or a very slight variation of the boiler patented by Mr. Bartholomew, in 1856. It is difficult to believe that there can be any partiality on the part of the Steam Department of the Admiralty to tubular boilers, the defects of which have been so fully explained by this Society's distinguished prizeman, Mr. Charles Wye Williams, and I am happy to hear that the Admiralty contemplate having a gun boat or two fitted for trial with the ipmrovements of Admiral Tucker and Mr. Blaxland.—E. J. R

Although I have thus pointed out the efficiency of our ships as compared with those of France and America, I by no means wish to to imply that the armaments of our steam fleets are not susceptible of improvement with the means already at our disposal. The very variety observable in the armaments of ships of similar dimensions indicates imperfection, and even evinces a sense of imperfection in the minds of the authorities who arrange them. Moreover, Sir Howard Douglas and Captain Dahlgren have particularised one class of gun which is much used by us, but which is too light for its duty, viz. the 10-inch shell-gun of 86 cwt. This gun has been superseded in the American navy, by one of 107 cwt., and should certainly occupy a less prominent position in ours. Other desirable modifications might, doubtless, be made, and the whole subject requires still deeper study than appears to have been bestowed upon it. It is, however, far too broad for any complete discussion of it to be here attempted.

Before passing to topics of a novel character, it should be stated, however summarily, that, in respect to those great features to which I have this evening to refer, viz., dimensions, forms, means of propulsion, and powers of attack and defence, the ships of our navy have become, during the surveyorship of Sir Baldwin Walker, the embodiments of all such sound and well-tested improvements as have been hitherto found compatible with the purposes for which ships of war are designed. This is a very broad statement, and one which I should not venture to make on my own responsibility only, lest I should seem to offer a compliment, which, coming from a private individual, would at least be valueless. But, as the present Surveyor of the Navy is so often commended in Parliament, by officers of the greatest judgment and experience, I do not hesitate to speak of the facts as I find them. I may state, then, first that the dimensions of our ships are increased, as necessity seems to require, without any kind of prejudice. We have 50-gun frigates of nearly one-fourth greater tonnage than the largest line-of-battle ships of fifty years ago. Then the tonnage averaged in large ships about 25 tons per gun; now it averages in our frigates 50 tons per gun; it is true that this difference partly arises from the introduction of the engines and fuel, but it is also greatly due to a wise increase in the carrying power of the ship, independent of her steaming requisites; again, the forms of our present ships have been adapted, by the introduction of fine water lines, to the circumstances attendant on screw propulsion, so as to ensure the high speeds for which our navy has lately become remarkable. Sir Howard Douglas, in his treatise on "Naval Warfare," refers this quality partially "to the adoption of the *wave principle* in forming the bows." This, however, is a mistaken though a very pardonable supposition. Mr. Scott Russell's wave-line theory, which, whether right in all or in some only, of its features, has been the occasion of vast improvements in ship construction, is not, I believe, adopted by the Admiralty. Many of their ships have, it is true, some water lines which are hollow; but this has arisen not from any admiration for hollow water-lines as such, but from the necessity of combining a convex bow above the load-water-line with fineness and straightness of form at that line, which cannot well be done without giving a slight degree of concavity to the bow below. The extent to which the present surveyor has adopted the screw propeller has already been mentioned; and it may be here added that most of the engines fitted to the steam-ships of our navy are among the finest specimens of marine engineering. The remarks I have already made on the armaments, and those I have presently to make on the armour defences of our modern war-ships, will be seen, on the whole, to give completenesss to that favourable opinion which I am here expressing. All this does not, of course, imply the absence of minor defects, but it does indicate that the present surveyor of the navy, with the able and well-trained scientific assistants, has not been slow to adopt changes when associated with improvement.

I have now to consider the exceptional vessels denominated floating batteries. The first I shall mention is the *Spanker*, which was designed about the year 1800, by Mr. Richard White, and of which Mr. Fineham, in his "History of Naval Architecture," gives the following account: "This vessel was intended to be a formidable floating battery, to carry guns of large calibre and mortars, so as to be suited for offensive operations in bombardment as well as for the defence of harbours. She was on the deck, 114 feet 6 inches; 42 feet 4 inches in breadth. The main deck was of an oblong shape, and square across at the bow and stern, so that four guns might be fired in lines parallel to the keel. This deck was made to project beyond the bottom, and was intended to be sufficiently high above the water that when boats should go alongside to board, they might be drawn under the projection in which scuttles were formed to fire through into them; but the ship had not enough displacement, and the projection was therefore brought too near the water for the boats to go beneath it. Under sail this vessel was unmanageable; hence she was soon kept for harbour service alone, at Sheerness."

No floating battery was again undertaken in England until the late war with Russia, when the Emperor Napoleon commenced the building of several of these vessels, propelled by steam, and protected over their whole assailable surface with thick armour plates of iron. The original conception of iron-plated vessels has been generally attributed to the Emperor; but he was by no means the first proposer of them. In the second volume of the "Mechanics' Magazine," published in 1824, was an article in which notice was taken of a memoir written by a M. de Montgery, a Captain in the French Navy, in the following terms:—"M. de Montgery contends, that while we have vessels of war constructed of wood, they should at least be plated with iron. Long before any one had thought of substituting metal for wood in the construction of large vessels, plates of iron or brass had been used for covering ships of war and battering rams. The celebrated galley built by Archytus and Archimedes, for Hiero, tyrant of Syracuse, was cased in this way. Philo of Byzantium afterwards proposed using battering machines made entirely of metal; but Father Mersenne appears to have been the first who thought of adopting them for ships. M. Montgery, says, that to render the sides of a vessel shot and shell proof, they should have a plating of iron about six inches thick; that is, a series of sheets of iron with blocks of cast iron between." The proposal to use plates of iron on the sides of ships was likewise made many years ago by General Paixhans, in his "Nouvelle Force Maritime."

The Emperor Napoleon having undertaken the construction of such vesssels, and the English press having become apprized of the fact, a similar undertaking was, to a certain extent, forced upon the Admiralty, and the eight remarkable structures which now exist in our harbours are the result. It cannot be denied that these vessels were prematurely built, or that they are in many respects inefficient as ships of war. In the 4th edition of his "Naval Gunnery," published in 1855, Sir Howard Douglas stated several very cogent facts bearing upon the construction of these craft. To one passage in particular I would refer: "Nor will iron slabs, 4½ inches thick," he said, "be proof against 68-pounder or 84-pounder solid shot, with which it appears the Russians are plentifully provided; and unless the timbers of these vessels are enormously thick, such heavy shots will not only punch holes in the iron, but may also make great breaches in their sides by their prodigious power." In confirmation of these observations, I may state that some of the worst effects stated to have been produced by the late gun-practice at Portsmouth upon the *Meteor* and *Erebus* floating batteries, were consequent upon the yielding of the timbers, or of the ribs, rather than upon the penetrability of the plates. I cannot speak with absolute certainty upon this point, because, as the experiments were of great public interest, the Lords of the Admiralty were most careful to have the shot-holes covered over with canvas as soon as they were made! I have since applied to their lordships for copies of the reports made upon the trials, but their lordships were unable to comply with my request.

And here I may be permitted to mention a remarkable idiosyncracy of Lords of the Admiralty, viz., that they seem to consider it a special function of theirs to deny to the British press and the British public, and to the natives of minor states from which we have nothing to apprehend, information, and facilities for gaining information, which they cheerfully accord to officers of the French, Russian, Austrian, American, and all other Governments which can by any chance prove inimical to us. I have known Russian officers, in particular, have authority to pass freely over our dockyards, while Brazilian officers are refused permission to enter the gates even to see a ship launched, and while Englishmen have to go about under the *surveillance* of a policeman. While no manifest good results from this system of being needlessly communicative to dangerous foreigners, and needlessly secretive to innocent Englishmen, it has the effect of occasioning much unnecessary and injurious babbling in newspapers and elsewhere. When all that the Admiralty do is done secretly, so far as we are concerned, men the most insignificant, whom a plain fact or two would appal, consider themselves quite safe in penning grandiloquent essays upon Admiralty shortcomings; and even just and able men are often betrayed into false criticism. And a greater evil is still to be found in the trouble occasioned by incompetent persons undertaking to do the work which the Government appears to neglect so grossly. Scores of well-meaning men, at this moment, believe that the offices of the Admiralty and the Surveyor of the Navy stand in the midst of all the bustle of modern progress, like a kind of sleeping palace, to the inmates of which—

> Faint murmurs of improvement come,
> "Like hints and echoes of the world,
> To spirits folded in the womb;"

—such men never thinking for a moment that most of the propositions which they are content to put forward in the crudest possible form, have long since been thoroughly examined, down to their minutest detail, in the offices at Whitehall.

And while I am speaking, parenthetically, I would remark that there are some facts now kept scrupulously secret by the Admiralty to which publicity should undoubtedly be given, viz., the results obtained on the trial-trips of the steam-ships of the navy. These are of the utmost importance to men of science, who are anxiously waiting to apply them to the elucidation of difficult questions of fluid resistance—questions of fundamental importance in naval architecture; and as the ships were built, the engines provided, the fuel furnished, the facts observed, and the results recorded, all at the public expense, it is difficult to see by what right any paid servant of the Crown or country prints these documents—still at the public expense—and then turns the key of his desk upon them. This subject must be pursued hereafter, if the ground of complaint be not removed.

But, to return: the floating batteries built by the Admiralty are undeserving of that utter condemnation which some have pronounced against them. Sir Charles Napier, for instance, committed a great error when, in a letter to the *Times*, he mentioned "Iron floating batteries which could hardly swim, and if they could would have been useless, for had they been placed within

400 yards of Sveaborg they would have been annihilated, and at 800 yards, they would have done no harm." Those batteries are armed, as before stated, with 68-pounders, and Sir Thomas Hasting's experiments on the *Prince George* hulk twenty years ago proved that at 1,200 yards 68-pounders are highly destructive, and we all know that they are so at even much greater ranges. The true defects of the batteries lie, not in any weakness of armament, but in their slowness of speed, their unmanageableness at sea, and, as the late experiments appear to show, the weakness of their frames.

But scant justice would be done to the designers of H.M. ships if I were to omit to state that the difficulty which besets this question of the construction of iron-plated war ships—of which we have lately heard so much—is far greater than amateur designers appear to understand. Of the many scores of propositions which have been made of late years but extremely few will bear the test of a practical embodiment. The first, and, indeed, the only very serious difficulty experienced in designing ships to be plated with iron four inches thick and upwards, is that of supplying sufficient displacement to sustain the imposed weight without resorting to great draught of water or immoderate dimensions. Various devices have been proposed for evading this difficulty, the most notable of which is, that of covering a portion only of the vessel with armour plates—the bow, according to some; one side of the ship, according to others. These plans are for the most part attended by too many and too great disadvantages for them to be adopted. Propositions have likewise been made for covering ships with strips of iron, filled in between with hard wood; for reducing the thickness of the iron plates and backing them with india rubber; and for many other modified arrangements. But hitherto experiments have proved adverse to these plans. It has been further suggested that the submerged portion of the ship might be made much longer than the portion above water. This plan has been adopted to a limited extent (for a different purpose) in the French gun-boats; and, although experienced naval architects will discern several objections to this mode of construction, it appears to me likely that the displacement might in this way be increased without the entailment of any great drawbacks.

Another proposal which I have met with in several quarters is that of reducing the thickness of the iron armour and placing it at an inclination, in order to reduce the effect of shot, which are supposed to strike horizontally. The name of Mr. George Rennie is most prominently associated with this proposal, in consequence of his having read a paper in advocacy of it at the British Association in September last. Mr. Rennie prefers the use of curved plates, but as a curved surface is but a surface of varying inclination, the principle involved is of course the same in both cases. It needs, I find, no appeal to experiment to show that the proposed arrangement would not be attended by any advantage. The simplest theoretical consideration shows that, for a given height of bulwark, the same quantity of metal will be required to resist a given blow, whatever the inclination may be. If a shot moving horizontally strikes an inclined plate, the crushing force exerted upon the plate is equal to the crushing force which would have been exerted upon it if upright, multiplied by the sine of the angle between the inclined plate and the horizontal. To keep the crushing effect constant, therefore, the thickness of the metal must also vary as the sine of that angle; and since the length of the inclined section varies inversely as that sine, the sectional area of the plate, and consequently, its weight, remain unchanged. Hence, the side of a ship will require the same weight of metal upon it in order to resist horizontal shot whether it be upright or inclined. The curving of the plates would render it necessary to make them of a variable thickness throughout, if the minimum amount of metal is to be used, and I need hardly say, that plates could not practically be used in this manner. Another important objection to Mr. Rennie's system is, that an inclined side would be much more injuriously exposed than a vertical side to the action of shot and shell fired from long ranges, and of a plunging fire like that of the "Wasp" battery, from which several ships suffered so severely in the attack on the sea-faces of the fortresses of Sebastopol.

Sir Charles Napier's plan of cutting a three-decked ship down to a frigate, covering her with thick armour plates, fitting her with a screw, and arming her with 10-inch guns, as proposed by him in the House of Commons in April last, superficially appears a very reasonable one. At the same time it is one that Sir Charles himself would probably, on mature reflection, consider it not prudent to adopt. It would cost from £80,000 to £100,000 to alter a single ship in this way, and when altered she would be deficient of some of those excellent qualities which he has for many years justly extolled.

It is time that all those who concern themselves with this great question of how iron may best be rendered available for the defence of ships' sides, should recur to the circumstance which gave rise to it, and to the true end to be at present attained. That circumstance undoubtedly was the introduction of Paixhans shells into naval warfare; and the end desired is the application of means by which the entrance of those terrible missiles through the side of a ship may be avoided. The attainment of this end would leave us subject only to the entrance of solid shot, to which all our ships were exposed during the wars in which we won our supremacy, and from which no practicable system of iron plating can at present be expected to save us. The attempt to build ships which shall be proof to solid shot—at least, to wrought-iron solid shot—is an altogether illusory one; and such ships are not urgently required. It is as a defence against shells, and hollow charged projectiles generally, and against these only, that iron plating can yet be made available. By applying iron of very great thickness between wind and water, we may reduce the liability to injury by shot at that important part, and it may be well to do this; but if the upper works are made shell-proof we can expect no more. These considerations reduce the question to a form in which it may be practically dealt with, and I doubt not the solution of it is not very distant.

The only suggestion I have personally to offer upon the point is one in which I find I have, like many others, been altogether anticipated by the gentlemen at Whitehall, but which I may nevertheless mention. It will be evident that fifty feet in length of iron plating on the bow or stern of a vessel, while they would weigh the same as fifty feet of similar plating near midships, would cover and protect a much smaller volume of the ship. I would propose, therefore, that the midship portion of the ship only be protected, and that it be separated from the forward and aft portions by strong iron water-tight compartments, so that, however much the extremities might suffer, the ship would still be safe, and the men protected. Means would of course have to be provided for extinguishing any fires which might be occasioned by shells in the undefended portions of the ship. This plan has been considered, I believe, but whether it is judged favourably or not I am unable to say—probably not, as it does not appear to afford any defence against raking shot.

I have yet to notice a correspondence which has lately appeared, chiefly in the *Times*, on the construction of what are called "steam rams," in mentioning which reference need only be made to the designs of Mr. J. Nasmyth, and Vice-Admiral Sartorius. I have not taken the trouble to inquire who first invented them, because I consider little invention was necessary in the matter, when the mind was once permitted to contemplate the use of such agents of destruction. Any merit that may exist in relation to them must arise either from the development of special adaptations, contrived so as to render the embodiment of the general principle practicable, or from the setting forth of arguments tending to show the possibility of employing such agents with undoubted advantage. Neither Mr. Nasmyth nor Admiral Sartorius has hitherto done either of these things publicly. Mr. Nasmyth informed us, in the *Times*, that he sent detailed plans of his proposed vessels to the Admiralty, several years since; and were his time less occupied than it is just now by those scientific studies and labours for which he is so justly and eminently distinguished, we should have had the satisfaction of examining similar plans here this evening. In the absence of these, however, it is impossible to say whether he has fully grappled with the practical difficulties which have to be overcome, and fully arranged those details in which the whole question of practicability or impractability is really, in such cases, involved. I have some reason, however, for thinking that Mr. Nasmyth has done much in this respect; for, on requesting him to inform me if he had made provision for enabling the engines of the ram to sustain the shock of a collision, I found that, although he did not apprehend derangement from this cause, yet he had anticipated it in his plans, and provided for it. This he did by placing the engine and boiler on a slide bed, and furnishing it with suitable elastic buffing material to admit of the slight run forward, which might tend to take place at the moment of collision. The screw-propeller shaft would, in like manner, have a suitable tube socket connection, which would allow the engine to slide forward, and yet keep up the integrity of the connection between itself and the screw-shaft. Mr. Nasmyth proposes to use no guns, but to content himself with the effects of the collision, which he enhances by the use of a powerful submerged percussion shell, which should strike the enemy several feet below water, and thus effect a ruinous breach, leaving her no chance of escape. He asks the government to make experiments with such a vessel, and believes that a "covey of such chicks" would effectually preserve our coast from attack. The scheme of Admiral Sartorius differs from that of Mr. Nasmyth only in the addition of an armament of heavy guns to his vessel, and in the suppression of the percussion shell. He would of necessity require a large vessel; indeed, he himself proposes to cut down the *Great Eastern*, cover her with shot-proof iron plates, fit her with a screw at each end, arm her with heavy guns, and make a ram of her. I should add that he would build upon her towers, from which scalding water might be pumped upon boarders. My opinion is, that there is not a steam-ship in our navy, nor even a sailing ship which, except in a dead calm, would not evade the blow of such a vessel. If a ship would lie at rest and wait for her, the gallant admiral's scheme would answer perfectly, but no long ship—which must necessarily occupy considerable time and space in turning—could be expected to answer the end which he assigns to her. Of the two schemes, Mr. Nasmyth's is by far the most promising; since, by excluding the armament, he could keep his vessel comparatively light and short, so as to be easily steered; but whether his percussion shell would be effective against the iron plates which would, of course, be carried down to resist it, and, at the same time, leave his own craft unscathed, is a very doubtful matter.

Before quitting this branch of my subject I ought to add a word on Mr. Macintosh's system of warfare, which Lord Panmure for a time forcibly suppressed. It consists in surrounding fleets or fortresses by floating naphtha, firing the same with potassium or otherwise, and thus enveloping the enemy in a cloud of vapour which either destroys him or drives him from his guns. This is not a mere theoretical proposition made without consideration, the inventor having chartered a vessel during the war, and proceeded to the Black Sea with a cargo of naphtha for the purpose of attacking Sebastopol. His amiable intentions were frustrated by the indisposition of our admirals to adopt so great an improvement.

Having now hurriedly reviewed the modern changes which our ships of war have undergone, and glanced at those floating suggestions which some are so eager to urge upon the government, it will be well to consider for a moment a few facts bearing upon the immediate future of our navy. And, first, there cannot be a doubt that the government can, if they please, hasten the introduction of great and radical changes. It is perfectly within their power to build ships of war of a far more destructive character than those which this or any other nation now possesses. But would it be politic for us to take the lead in such innovations? A navy like that which we possess involves, it should be remembered, the investment of an immense amount of capital. The cost of a ship of war when rigged and equipped may be estimated at £35 per ton, exclusive of the cost of her armament, and the engines involve a further expense of, say, £60 per nominal horse power. We have in our navy at the present moment 607 fighting ships, of an aggregate burden of 665,220 tons, and carrying engines of scarcely less than 100,000 horse-power. Therefore our ships alone have cost us nearly £22,000,000; and upon their engines we have made a further outlay of nearly £6,000,000. Consequently, we have invested in these ships nearly £28,000,000. Now, any radical change in the construction of war ships must tend to render this enormous sum of money lost to us, and entail upon us a fresh expense of like or of greater amount. No other power has so large and expensive a navy, and, therefore, no other nation has so much to lose by sweeping changes. As good economists, we should not then be over hasty in developing new means of naval warfare in times of peace.

The defence of our coasts is, of course, at all times a legitimate subject of improvement, and no necessary pains should be spared in rendering that complete. But that may be best done by manning a sufficient number of the ships we have, rather than by devising new ones; and the existing government will deserve great praise if they provide the means of doing this. There is no sign of weakness now visible in the navy of England save in its lack of men. The ships we possess carry no less than 15,140 guns, and could these be all discharged at once, would, at each round, project 254 tons of iron! In one day of twelve hours, firing but one round per minute, they would therefore project 914,000 tons, enough to form a solid cannon ball 120 feet in diameter. To fully man all these ships, and bring all their powers into play, we should require but 162,000 men, and if we had but a fair proportion of these to call upon in an emergency, our defence would surely be complete.

It will probably be objected by some that the French and Americans are building a new class of formidable vessels, and that we must, therefore, do the same. But the assumption of such objectors requires proof. The "ram's nest," lately discovered in America, is very much like another kind of nest which some people are very often finding. The "ram" that it contains need occasion no alarm. It has already cost the American Government 800,000 dollars, and a committee appointed to examine it is said to have reported that it will take 800,000 more to complete the operations begun. It is, therefore, exceedingly likely to remain in its nest for very many years to come; indeed, an American scientific paper some time since pronounced it fit only for exhibition to visitors, at three cents. a-piece, as a monument of folly. As to the French, they have, like ourselves, many inducements to refrain from great innovations. Where we have 60 steam line-of-battle ships they have 30; where we have 330 steam ships they have 220; and where we have 600 ships in all they have 400. Further, much that we have heard of their proceedings is not only false, but ridiculous. The rumour that they were building six *polished steel* frigates, by which some persons were recently plunged in deep distress, was manifestly put forth to excite our foolish fears; and statements less evidently absurd are doubtless often started with a like object. The French navy itself, though too costly to be thrown lightly aside, is greatly inferior to ours, as we have just seen; and the Emperor can be doing nothing that our Government are not advised of, and which they are not, therefore, at liberty to do also; and doubtless would do, were it anything formidable. Certainly nothing yet made public need excite our apprehension. Give us a strong Channel fleet, liberally manned and well disciplined, and no power that the French, or any other Government, possesses would dare to menace our coasts; nor would any man venture to say, with Sir Francis Head, that nothing but the will of a foreign Emperor kept London secure from a foreign army.

Let it not be thought that the economical considerations before alluded to should be suppressed in the discussion of this topic. Certainly, economy should not be carried so far as to cripple the Government in defending either Great Britain or its dependencies; nor should it be permitted to impede those researches and experiments which may be essential to the full and prompt development of our strength in time of war, should that arrive. But surely this country, with no offensive or aggressive ends to attain, and yet possessing a navy worth twenty-eight millions of money, and crowded, as it is, with a fearless and patriotic people, need not wince at every hostile whisper, or spend another million on war-ships every time a foolish foreigner boasts; nor can it be amiss for such a nation to count the cost of so timorous a policy.

But if we are resolved on advancing at full speed in these matters, we have need to prepare ourselves for such navy estimates as we have never before known. For there never was a period when the art of naval warfare was more susceptible of change than it is at this moment. Fifty years ago the dimensions of vessels were, by common consent, at least, limited; the power of our ordnance was practically stationary; the winds of heaven were our only propellers, and blew on all fleets equally. But now we build frigates much larger than the line-of-battle ships of that day, and know of nothing to hinder us from building them twice as large if we will. Our guns are incessantly improved,—now by one, now by another, and the breech-loading rifled cannon which Mr. Armstrong has just given us, and which ranges, I am told, four miles, may be quickly succeeded by another of twice its range. The paddle-wheel has made us independent of sails; the screw has made us independent of the paddle-wheel; and the 200 horse-power engine of the *Rattler* has been followed by the 1,000 horse-power engine which is to drive the *Mersey*, and that may speedily be replaced by one ten times its power. A single improvement in the manufacture of iron, which hundreds are now seeking daily to improve, may at any moment give us the means of carrying our steam pressure to unheard of heights,* of resisting shells with the utmost ease, and of augmenting the strength of our ordnance tenfold. By eagerly arming ourselves with all the warlike agencies with which science may thus supply us, regardless of all consequences, we may certainly make our navy most terrible; but we shall at the same time, by the very preponderance of our might, compel all other powers, secretly at least, to make common cause against us, and thus prepare the way for universal strife. On the other hand, if we content ourselves with vigilantly observing the changes which other powers make, and adopting only such improvements as are necessary to keep alive that wholesome respect which all nations now feel for us, we shall neither encourage ambitious powers by our weakness nor alarm timid powers by our strength, but shall continue to stand a solid and impregnable bulwark in the shelter of which men may peacefully work out their highest and noblest destinies.

DISCUSSION.

Mr. C. Macintosh, in complimenting Mr. Reed on his able paper, could not but say that the magnificent steam navy, to which allusion had been made, sailed to the Euxine and the Baltic, and having taken up positions before Sebastopol and Cronstadt, remained there for months without doing anything in the shape of attack. The Admiralty were informed, in 1853, of the number and calibre of the guns in these fortresses, which, by their concentrated fire, were sufficient to annihilate half-a-dozen British navies. The approach could only be made by a certain path, which was commanded by guns sufficient to sink 500 ships. Thus the British fleet remained out of range of the guns of the forts, their own guns being also unavailable for attack, and all they did was to keep the rats in their holes. His object had been to introduce to the authorities of the Admiralty an invention* which would have enabled the English fleet to have advanced under cover of a thick vapour close up to the sea faces of the fortresses, when they could have poured in a concentrated fire that would have annihilated them. In the attack upon Sinope the Russian Admiral waited for one of the Black Sea fogs, which so frequently occurred, under cover of which he advanced to an attack which, though bloody in its issues, he (Mr. Macintosh) regarded as the most brilliant action of the whole war. He submitted that if his plan had been carried out during the Russian war, the lives of 50,000 brave soldiers might have been spared, and the expenditure of millions of money saved to the country. Mr. Macintosh entered into a description of his plan, which consisted in diffusing a large quantity of naphtha upon the surface of the water, either around a ship, or in front of the sea face of a fortress. This body of inflammable matter was lighted by firing a prepared shell containing naptha and potassium into it, and thus an impenetrable vapour was created, under cover of which an attack could be made with the most destructive effects.

Vice-Admiral Sir George Sartorius said, his name having been mentioned in the paper, he would offer a few observations with the view of clearing up that which would otherwise be somewhat unintelligible. When Mr. Reed communicated with him on this subject, he asked for information which was unpublished. He then presumed that Mr. Reed was fully acquainted with the correspondence that had appeared in the *Times* with reference to the steam ram; but from the statements made by Mr. Reed, it was clear that he was not fully acquainted with that correspondence. It was more than two years since the subject of steam rams was brought before the notice of the Admiralty. But the proposed adaptation of the Great Eastern ship to that purpose had only been recently put forth. When he proposed the plan of steam rams to the Admiralty, he was not aware that a similar suggestion had been made by Mr. Nasmyth, and he felt proud that he should have conceived an idea which was participated in by so distinguished a man. The plan suggested itself to his mind from having noticed the results of the collisions of vessels at sea, the effect invariably being that when an iron steamer propelled at great velocity, came in contact with a vessel moving at less speed, the latter sustained serious injury. As to the form best adapted for an aggressive engine of that description, not being himself an engineer or a ship builder, he did not consider himself competent to determine it. He therefore consulted with persons more particularly acquainted with the subject than himself, and amongst others, Mr. Scott Russell. They had all told him that there was no difficulty in constructing a vessel of suitable tonnage and form with sufficient weight of iron around it, and propelled by a power that would sink any vessel with which it came in contact. He had proposed a vessel of from 3000 to 4000 tons, to form a shot-proof steam ram. If it was admitted that such a vessel could be constructed shot-proof, he would ask any practical sailor how it was possible for a fleet of twenty or thirty vessels to resist the effects of such an engine of destruction. The masts could be lowered, and by having a rudder at each end, the difficulty of turning the vessel, alluded to by Mr. Reed, would be obviated. He proposed to have the keel slightly curved so that the vessel could be more rapid in changing the direction of its movements, and by the extent of steam power employed, it would have considerably higher speed than the ships of the present day. A subsequent proposition of his has been to furnish the vessel with guns from which shot filled with molten iron could be discharged, which would fire the wooden ships against which they were projected. Another project was the suspension of percussion shells from the bow, which could be fired by the concussion of the two bodies. A vessel so armed would sink the largest ships afloat, whilst the projectiles would set them on fire. He confessed, that the introduction of Armstrong's new gun had tended to alter his views upon this subject, for it was evident that a shot from that gun would go through every thickness of iron that could be reasonably used in the construction of a vessel. Under these circumstances, he maintained that ships built of timber would be useless in any future war, and if the plan of the steam ram were a favourable one, ordinary iron ships of war would be alike useless.

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* A simple but very important improvement in boiler plates, lately introduced by Messrs. Alton Fernie, of Derby, deserves mention in this connection. It consists in thickening the sides of plates, and bending the thickened parts to form the angles of boilers and other vessels, so that the ordinary plates may be rivetted directly to the turned down portion of the thickened plate without the use of angle iron. The full value of this invention it would not be easy to state. In addition to its direct advantages, it has the further one, doubtless, of getting rid of that unexplained, but very common cause of failure of boiler plates, not at the joints, but in their neighbourhood.—E. J. R.

* See *Journal*, vol. vi. p. 681.

Mr. William Hawes said, after hearing a paper so simply yet so eloquently written as that which had been read that evening, it was rather hazardous to get up and object to one or two principles which it advocated; but there was one sentence in particular which grated harshly on his ear—it was with reference to the contracts by private builders during the late war—and Mr. Reed had stated that the evils of pecuniary losses were greatly aggravated, if not altogether occasioned, by the excessive demands for wages made upon the contractors by their workmen. He thought great injustice was done in that observation to a class of men to whom this Society ought to pay the greatest respect. He believed that if the truth of the matter were known they would find that the contractors, and others filling positions above those referred to, took advantage of the war to increase their charges to a much greater extent than had been done by those in their employment. He was at all times anxious to defend workmen from such charges as these, and he thought in all statements made in public we ought not to lose sight of the position in which both masters and workmen were placed in cases of great emergency. There was one other important principle advocated, namely, that we were to sit still and wait till improvements were introduced in other countries before we adopted them. That, certainly, was not the principle which had guided us with regard to the manufactures of this country, and he should be sorry to see the time arrive when that plan would be acted upon with reference to our vessels and instruments of warfare.

General Sir Charles Shaw, as one not acquainted with naval matters, said he, ought to apologise for offering any observations on the subject. He had served as commanding the marines under the gallant Admiral in the chair, as well as under Admiral Sartorius. With reference to the question—how was the propulsion of vessels to tend to our national defences—it had often occurred to him that, with the means at present in use, an entire system of military improvements could be carried out with a fleet of steam ships in the same manner as with a brigade or division of an army on land. The introduction of those new instruments of warfare—the Enfield rifle and Armstrong's gun—had completely changed the system. What was the use of fortifications, when they could be attacked from a distance of five miles? They must build their arsenals inland, and by the aid of the electric telegraph an order could be executed as well at Coventry as at Portsmouth. Supposing an enemy destroyed the coast defences, they could not command more of the country than their shots could reach. Therefore, if they drew up a second line of defences out of range, no enemy could land.

Captain Norton mentioned that, with the present military rifle he had pierced an iron plate $\frac{3}{8}$ths of an inch thick at a distance of 60 yards. He had for some time anticipated that rifled ordnance of the largest size would come into use.

Mr. James Nasmyth, upon being called upon by the Chairman, said that the plan of his steam ram had been so widely discussed by practical men in all quarters, that it would be imposing upon the time of the meeting to enter into any detailed description of it; but he was at any time ready to answer any distinct question that might be put to him with regard to it, in order to elucidate any points in its construction which might not have been given with sufficient clearness.

Mr. J. Scott Russell, F.R.S., was afraid the hour was almost too late for him to take up their time with what he had wished to say, and to bring the discussion back again to the special scope and peculiar objects of the paper. All who were in the habit of meeting in that room, must feel that the paper which they had just heard was a most valuable one; and it was particularly valuable to himself, as he had been endeavouring to get together for his own use, the information which that paper contained, forming the history of the progress of our navy during the present century. There were, however, one or two points in it upon which he felt it his duty to say a few words—not because they were topics peculiarly his own, but because he thought it necessary in justice to other people to do so. Mr. Reed had in his paper very carefully given to every man whose name he had mentioned his due share of blame for his mistakes, and approbation for what was right. He agreed with Mr. Reed that it was a great misfortune for England that at one time other ships were constructed—he would not say with a total want of principle—but upon maxims which were opposed to all received principles. It was the doctrine for a considerable period of time in the Admiralty, that science could do nothing whatever for shipbuilding, and that there was no greater qualification for a shipbuilder than that he should know nothing whatever of the subject. Whilst he quite agreed with all that Mr. Reed had said of Sir William Symonds and his school—if he had a school at all—he would say that they must give that officer credit for one thing—namely, that he was the means of introducing into the navy the large, broad batteries which his ships first set the example of carrying, although they did not carry them well. The large batteries were still retained in the navy, and ships suited for carrying them were now scientifically constructed. Sir William Symonds was an admirable seaman; but to believe that because a man was a good sailor, therefore he was a good shipbuilder, was much the same as to say that because they had a good coachman they would set him to build their coaches. He knew Mr. Reed to be an educated naval architect, and he therefore thought that he might have dwelt a little more upon the very great merit of the more modern school of naval architecture, which he might say had overthrown Sir William Symonds, and had now taken his place. It was, perhaps, not generally known that during the official reign of Sir William Symonds, there was, struggling against every difficulty, a body of trained naval architects of very high scientific attainments. That young school of naval architects struggled through the opposition which the authorities of that time threw in their way, and determined to introduce scientific naval architecture practically into the navy. They were appointed by a more enlightened Board of Admiralty that came into power at a later period, a committee of naval architects, and during the reign of Sir William Symonds, that committee (one member of which, Mr. Chatfield, he saw present)—discussed the principles on which the future fleet of England should be constructed. They produced a report, which he was afraid was not made so accessible as it ought to be. He had himself obtained a copy of that report in a circuitous way. Those gentlemen however produced a treatise upon naval architecture, which he had no doubt would be given to the world at some time or other, and which would do great credit to the authors. About a dozen gentlemen constituted that school of architecture. The present surveyor of the navy on coming into office, adopted a very different principle from that of his predecessor. He said, "I am surveyor of the navy, but, understand, I am not a naval architect. But I will do this: I am an experienced sailor. I know what I want in a ship; and what I will do is I will associate with myself the most eminent naval architects I can get. I will tell them all that I want in a ship, then they shall inform me in what way they will give me what I want." It had been his (Mr. Scott Russell's) theory that two men were necessary to the designing of a ship—one, the naval architect, and the other the man who had to fight her. That was the reason why there should always be a naval man in the construction of a ship as well as a ship-builder. It was this state of things which had raised the navy of this country to its present state of efficiency. He was one of those who were often finding fault with the Admiralty; it was, therefore, a great comfort to him to say all the good he could of them. They were going on very rapidly making great improvements, and they certainly did wonders in the last war. He believed they were not standing still now, but had their eyes open. Still he thought they required a little pressure from such persons as the gallant Admiral in the chair: and even this paper and the discussion upon it might help them to go forward. He believed there were some men upon the Board of Admiralty who wished to go on very fast, and no doubt there were others pulling them back. If, therefore, the screw were put on, they might be induced to move forward. He thought they owed much to the present Surveyor of the Navy. It was to the Admiralty authorities that the introduction of tubular boilers was to be attributed, which formed so large an element of economy and speed in merchant vessels. It must not be forgotten, moreover, that we owed to the Admiralty the introduction of the screw-propeller. It was not introduced so soon as it ought to have been, but it was introduced a great deal sooner into our ships of war than into the merchant service, and Government ought in fairness to have the credit of this. With regard to the construction of iron batteries and iron frigates and rams, he thought there were one or two persons who ought to be done justice to. The introduction of iron plates originated not with the Emperor Napoleon, but with Mr. Stevens, the great steam-boat builder of New York, who was in this country ten years ago, and who then communicated to him (Mr. Scott Russell) the results of some experiments that had been made by the States' Government with regard to iron plates. Much had been said about the great steam ram which was building in America, and which had been commenced by the same gentleman, but from all that he (Mr. Russell) had heard about it, he thought it was a very clever idea, quite clever enough to be begun, but a great deal too clever ever to be brought to a successful issue. He believed they were indebted to Mr. Lloyd, of the Admiralty, and not to Louis Napoleon, for the idea of the four-inch iron plates. The Emperor suggested the putting on of a number of thin plates to make a thick covering, but Mr. Lloyd suggested that one thick plate would answer better. He sent to the contractors to ask whether they could make these large four-inch plates. They said it was impossible, but, nevertheless, if they were ordered, they would do it, and they did it as a matter of course. He would say one word in reply to what had fallen from Mr. Hawes. He (Mr. Scott Russell) did not believe that any manufacturer or builder of ships for the Admiralty during the war put on the screw in the way of money at all. They felt that the Government was in a difficulty, and he knew that the prices at which they then built for the Admiralty were less than those at which they were now contracting for the same description of ships. With regard to himself, he would mention that the Admiralty applied to him to cast some guns in a great hurry. He replied that he could not undertake to do it because the price he must necessarily ask would be greater than he found they were paying other people; but he offered to place his foundry at their disposal during the night, without charging them any profit, but that they should appoint a person to see how much money was spent, and if they paid that he would be satisfied. Others with whom he was acquainted acted in the same way. He was happy also to say, on the part of the English workmen, that the great proportion of them acted in a similar spirit; but he was sorry to be obliged to add that some of them, when they found that those vessels of war were wanted in a hurry, asked that their wages should be raised from 7s. to 8s. 9s. 10s. 11s. 12s. and even 13s. per day; and they struck work and left the yard, because when it came to 13s. 6d. it was refused. These were exceptions. As a general rule, the workmen of England during the war came out nobly, and the few instances he had mentioned were the rare exceptions. He was always proud of the workman when he did right, and looked upon him as an equal, and was never so much ashamed, being a workman himself, as when one of that class did wrong. He would sit down with the expression of his thanks to Mr. Reed, for the very valuable matter he had brought before them that evening.

Mr. Ditchbourne, in reference to the statement just made, that the present Surveyor of the Navy had called in the aid of naval architects, thought an injustice was done in that respect. In his opinion, the more suitable place for the Surveyor would be a seat at the Board of Admiralty, and that a naval architect should receive the appointment of Surveyor of the Navy.

Captain Fishbourne, R.N., as a naval officer, would tender his thanks to Mr. Reed for his able paper. He would remark that as it appeared at present impracticable to manufacture iron plates strong enough to resist the passage of solid shot, their attention ought to be turned to precision of fire from the guns. This appeared to have been attained to a wonderful degree by Armstrong's rifled cannon which, at 1500 yards, was said to be 50 times more accurate in its fire than any other description of cannon. Assuming that to be the case, one of those guns would be equal to 50 ordinary guns at 1500 yards. The precision of fire was so great as that they could send the shot into the port hole every time, by which the enemy's guns might be destroyed, and the men working them killed. With regard to iron plates for covering the sides of ships, he thought there was a difficulty which could not be got over—namely, that to obtain the requisite thickness of iron to withstand shot, the displacement of the ship would be so great as materially to detract from her usefulness, the great point being to get ships that drew as little water as possible.

Mr. Reed, on rising to reply to the several speakers, took that opportunity of stating to whom he was indebted for the display of models and drawings with which his paper was illustrated. For the several models of ships, he had, he said, to thank the Secretary of the Admiralty, who had granted the use of them without hesitation. He directed especial attention to a splendid model of H.M.S. "Euryalus"—in which a royal prince had lately proceeded to sea, for the purpose of acquiring, not valour, for that was doubtless born in him, but the skill which would enable him to apply his valour wisely. For highly finished working models of a marine engine and a breech-loading cannon he had to thank Mr. Joseph Maudslay, of whose valuable improvements they were good examples. A series of coloured lithographs, representing the combined fleets during the late war, had been kindly lent by Messrs. Day and Son, of whose productions they were excellent specimens. The large drawings illustrative of Mr. Macintosh's system of warfare were furnished by the inventor. The various speakers who had noticed his paper were so kindly in their criticism, that he had but little to reply to. He felt bound to say, however, that he had scarcely done justice to Admiral Sartorius in preparing his paper, not because he was unacquainted with the letters of the gallant officer, but because the time allotted for the reading of the paper was too short to admit of elaboration. His great objection to the present introduction of such vessels as Admiral Sartorius proposed was based, however, upon the consideration that it was unnecessary, and would be impolitic for us to enter upon the realization of such plans unless other powers first resorted to them. With regard to the turning of the ram when under weigh, it would be evident that, while the use of a propeller at each end would render it unnecessary to turn the vessel completely round, it would by no means obviate the necessity of rendering her capable of changing her direction suddenly while in pursuit. But this was a matter of detail, and, as he had before said, he had not attempted to fully discuss the details of the steam-ram question. With respect to the observations of Mr. Hawes, he (Mr. Reed) accepted as his own the reply which Mr. Scott Russell had so efficiently made in so far as the contractors and workmen were concerned. As to the resistance to progress which, as Mr. Hawes alleged, he had offered, it would be understood that one of the reasons why he (Mr. Reed) advocated moderation in the arts of war was that the arts of peace might thereby be promoted. In reference to Sir Charles Shaw's observations, he would simply remark that Sir Howard Douglas's "Naval Warfare," recently published, consisted principally of an able essay upon the application of military tactics to naval warfare with steam. In Captain Fishbourne's observations he discerned nothing that was not entirely in accordance with the paper he had had the honour of reading. To Mr. Scott Russell he was much indebted for the very excellent and able manner in which he had supplemented the paper, by remarks which were not only pertinent but most necessary, and which could not have been made by any other person with the same authority as the name of Mr. Scott Russell invested them with. If he (Mr. Reed) had passed lightly over the services of the members of the School of Naval Architecture, or, indeed, of any other person or persons, he must plead the enforced brevity with which he had written.

The Chairman said it was now his duty to propose a vote of thanks to Mr. Reed for his paper, which he must say was drawn up with great ability, and contained much valuable information. Before doing so, however, he would make a few observations upon one point of the paper especially, in order that it might not go forth to the public that we had the large available naval force there spoken of. Mr. Reed had stated that the fleet of screw steam ships consisted of fifty-one line of battle ships, each armed with 8-inch shell guns and 32 pounder solid shot guns, &c. Mr. Reed, in making that statement, undoubtedly meant that we had built and launched 51 sail of the line. He could not mean to convey that there was that force ready for service at the present day. He (the Chairman) sincerely wished there was, and then all their fears about invasion would be groundless. He believed there was not more than half that number. Of course he alluded to screw line of battle ships; because he regarded all sailing ships of war as so much waste timber, and the sooner we got rid of them the better. Mr. Reed had very truly said, that what was required was a well-manned Channel fleet, and with that we could set at defiance all the powers of Europe. But the difficulty was to get such a fleet—he meant a fleet manned by really efficient seamen. A Royal Commission was now sitting with a view to find out what were the real grievances of the sailors, and what was the reason men did not more readily enter the navy. He believed that commission would very shortly make its report, and he trusted that the Government would pay attention to it, emanating as it would from able and experienced officers, and not throw it aside as had been done with the last report made to them. A good Channel fleet was what he had always contended for; and he would point out in very few words how it could be obtained. They probably all knew that he (the Chairman) had both publicly and privately—in the House of Commons and elsewhere—done his utmost to induce the Government to get up a Channel fleet of only ten sail-of-the-line. He only asked for a fleet of that extent. The late Board of Admiralty paid off the fleet and sent the men to the right-about, even including the continuous service men. He was happy to say that the present Board of Admiralty—though a Conservative one—had done more during the time they had been in office than he had ever seen done by any former Board. It was pretty well known that he was no Conservative himself, but still he wished to do justice to those in office—whether they were whigs, tories, or radicals. When the present Government came into office they cast about to get up a Channel fleet. It was true they had not yet come up to the number which he wished, but they had got six sail of the line. He should continue to urge the Government to get them up to ten sail of the line; and if they had that number of ships well manned with real seamen—not men picked up out of the streets—there would be no difficulty in the event of an emergency in increasing them to twenty. He would tell them how that could be done. They should take ten sail of the line, manned by 1,000 men each. There should be only 100 marines instead of 200 embarked on each vessel, the rest being replaced by 100 seamen, and that would give 900 able seamen and officers on board each ship. The Admiralty were very properly preparing ten sail of the line as a first reserve, and these were nearly ready. In the event of war one watch should be transferred from each ship of the Channel-fleet above-mentioned to the reserve, which would then give a fleet of twenty sail of the line manned by 450 men each; let their complement be filled up by 200 marines and 100 officers and boys, who were always to be had—this would give a fleet of twenty sail of the line manned by 750 men each, and with 250 more for each vessel, called out from the coast volunteers, there would then be a fleet of twenty sail of the line better manned than was the fleet during the last war. This could be done in 48 hours, but he did not think that it was enough. There were now 7,000 of the coast guard, which were to be increased to 10,000, and there were in different sea-ports nine useless block-ships to receive them. For these block-ships he (the Chairman) would substitute the second class reserve of ten ships which were now getting ready, and taking the coast guards to man them, we could have in 48 hours more thirty sail of the line ready for fight, and with such a fleet we might defy the world. Those ships in the different ports would teach the sailors that an English man-of-war was not so bad a service after all. He was happy to say that he believed the feeling was gaining ground amongst the seamen, that to get on board a man-of-war was not a bad position. He regretted that they still kept those immense useless block-ships, mounting 74 guns, with reduced masts and yards, and some of them moved by machinery of only 200 horse power, which Mr. Scott Russell could tell them was of very little use. Of course to provide all this would cost money, and they must be prepared to hear, when the Navy estimates were brought forward, that we should require a considerable sum more than was at present voted. In his opinion much of the money was now ill-spent. They were now doing what they had never done before; Government was buying land at Plymouth, Portsmouth, and other places, and making immense land fortifications, at a cost of between £300,000 and £400,000; while formerly, when we had almost the whole world against us, the wooden walls of old England were found sufficient for her defence, and this would be the case again; and he considered that the money expended upon land fortifications was thrown away, except in so far as providing a few places with guns, under which vessels could run in for shelter. Let them have an efficient fleet, man it well, and it would be found the cheapest as well as the most effective defence of the country; and no nation, whatever might be the fleet she could send out, would ever then attempt to disturb the peace and happiness of England. It was true that France was making enormous strides. She had built an immense fortress at Cherbourg, and it had doubtless been built to put a large fleet in; and that no doubt would be done some day. France had a large army; this country had next to no army: our troops were in India, and even with the militia the number of soldiers at home was very small. He therefore said it was the duty of all Englishmen to insist upon the Government keeping up a good Channel fleet of not less than ten sail of the line: and that would be the nucleus of 30 sail of the line, which could be manned in the way he had proposed to them. He had thought it his duty—inasmuch as these proceedings would go forth to the world through the press—to disabuse their minds of the notion that we had at the present time 51 sail of the line, which might lead them to suppose that all attempts to get more ships would be useless. He was quite sure that the vote of thanks which he now begged to propose to Mr. Reed would be unanimously accorded.

The vote of thanks having been passed,

Mr. Reed acknowledged the compliment, and remarked that inasmuch as the returns he had given of the naval force of France up to May, 1858, included vessels under building and alteration, he thought it only justice to give the same statistics with regard to our navy.

The Secretary announced that on Wednesday next, the 22nd instant, a Paper, by Mr. Leonard Wray, "On Cotton Culture and Preparation in the United States," would be read.

HEALTH OF TOWNS.

In the public health section of the Social Science Meeting a paper was read by Mr. Marshall, the town clerk of Ely, on the results of tubular drainage of the city and the abolition of cesspools or middensteads in five-sixths of the houses, and the substitution of soil pans or water-closets. Instead of large "man-sized" branch as well as main sewers, at Ely the general outfall for the drainage of all the houses was only ten inches, and the prevalent diameter of the sewers was only six inches; and Mr. Burn, the able engineer, declares, that so well do they work that if he had to proceed *de novo*, he would use sizes yet smaller. So complete is their constant action, that they require no flushing, and everything is discharged in much less than an hour from beneath the more distant parts of the town to the outfall. It is reported that it is discharged "so fresh," speaking comparatively, that there is no offensive smell from the openings into the street, and that in the river no nose can detect the place of discharge, and in such a new condition (the grosser being detained and treated with lime) that instead of fish being killed, it is just at the outfall that the anglers find their best sport. He showed that the effect had been to reduce the death-rate from 25.60 to 17.20 per 1,000; or, in other words, as if the whole mortality of the city for one year out of three were intermitted. The average age of death had already been raised there four years and six months to every individual. Dr. Carpenter also gives a statement of the result of the tubular drainage of Croydon. These were stated to be a gradual reduction of the death-rate from 28 in 1,000 in the year of the commencement of the works to 15.90 per 1,000 in the last year. The death-rate, according to Mr. Westall's tables for the last five years had been gradually diminishing thus:

Year:	Rate per thousand.
1853	28.57
1854	26.52
1855	19.75
1856	16.70
1857	15.94

The population had been increased to nearly 28,000, contained in 4,546 inhabited houses. The number of deaths for the whole year was 437, or 100 less than in 1848, when the population was 9,000 less than at present. The death-rate was 15.94, instead of 28.16, leaving a balance of 12.22. To put it more intelligibly, the sanitary improvements have caused a saving in one year alone of 342 persons, if we suppose the mortality would have continued as high as in 1848; or even taking the mean of ten years—five before, and five since they have been in operation, viz., 22.92—the saving has been 196. The character of the disease has also altered.

Medical testimony was read to the effect that typhus had been almost driven out from its former abodes; and there had been a general reduction of sickness by about one-third. A similar report was read as to the results of similar works executed at Tottenham, which had almost cleared away typhus from a number of its former seats. A report was read on the effects of the sanitary improvement of the Arsenal district of Woolwich, where 70 per cent. of the houses had been divested of cesspools; and the result had been a reduction of epidemic or zymotic diseases by nearly one-half. The death-rate had previously been 33 in the thousand—it had early been reduced to 27 in a thousand—last year it had been as low as 19 in a thousand in the district in question. Other reports stating important results were read, in relation to works completed in Ottery St. Mary, Devon, and in progress in Lancaster, Worthing, and in other places; and resolutions were unanimously adopted requesting that the report should be printed and circulated by the council *in extenso*; that the results of the works in other places should be published and circulated for the public information.

Colonial Correspondence.

THE COMET.

Belize, British Honduras, Oct. 17, 1858.

Sir,—On the evening of the 30th of September a comet was observed in the north-east, a little above the horizon. The nucleus was large and brilliant, and the tail long and luminous. The nucleus, which appeared to be about the size of Mars, was of a reddish hue. The tail was of the same complexion near the nucleus and for a considerable distance from it, but gradually became paler and of a more silvery lustre towards the opposite end. The length of the tail was at least a third of the distance between the horizon and the zenith. It spread itself greatly, and at the broad end very much resembled the milky way, as that sidereal region of the heavens is seen in the tropics—not as it is seen in Europe. The motion of the comet was very rapid. As nearly as I could calculate, its apparent motion, when viewed by the naked eye, was an inch in a minute. It pursued a course from the north-east to the south-west. Every night it rose higher in the heavens, and as it approached the zenith, receded from the earth. The tail at first was nearly parallel with the horizon, but as the comet rose it became perpendicular to it. I have sent you a couple of pencil sketches, which will give you some idea of the size, shape, and course of that eccentric body.

I am, &c.,
R. TEMPLE.

Home Correspondence.

EXHIBITION AT BARNSTAPLE.

Dear Sir,—I am desirous to repeat, for the information of the members of the Society of Arts generally, the statement which I made from the chair on Wednesday the 8th inst., to those who remained in the room after the interesting discussion on Mr. Halkett's paper, namely, that a large Agricultural Society (the Bath and West of England) is about to extend its Exhibitions so as to include arts and manufactures, as well as objects of agricultural interest.

The Exhbition for 1858 took place at Cardiff, on special invitation from that town, which contributed £800 towards the expenses, besides £1,500 paid at the gates in three days. The Exhibition for 1859 will take place at Barnstaple, in the heart of North Devon, in which district a local subscription of £1,500 has been raised to secure a visit from the Society.

In compliance with the wishes of the exhibitors of agricultural implements, competition for prizes in that department is to be discontinued. The meeting will take the form of a Great Western Baazar for exhibition and sale. The regulations for such an arrangement have been submitted to a large number of the implement exhibitors assembled at the Smithfield Show, and they have promised to support the Barnstaple meeting by sending their best goods. The prizes for cattle and poultry remain as usual.

The Society possesses a plant of waterproof shedding (on a plan invented by Mr. Jonathan Gray, and adopted for hospital tents in the Crimea) capable of covering 40,000 square feet (two thousand feet run of twenty feet wide), for which the implement exhibitors pay cheerfully two shillings per foot run (22 square feet).

Arrangements will be made for more complete protection of articles exhibited, provided that exhibitors are willing to contribute to the expense in proportion to their several requirements. The Society does not desire to make any profit by the shedding.

The object of the extended Exhibition is, to engraft on the rapid improvement in agricultural produce and machinery a corresponding improvement in taste, and, thereby, to extend the local demand for works of art and manufactures, whether useful or ornamental, of the highest quality and the best design. The want of a better market is acknowledged in all the Schools of Design. The Art-Union of Glasgow has already taken one step—we hope to take another.

The retail shopkeeper is often unable—sometimes even unwilling—to step in advance of the taste of his own district. In order, therefore, to try our experiment with any hope of success, we must invoke the favourable consideration of enterprising and intelligent men at a distance. Is it too much to hope that some members of the Society of Arts will be disposed to enter, as a memorandum for the end of May, 1589, "Westward, Ho!"

The show will be open from Monday, 29th May, to Friday, 3rd June, both inclusive. The Secretary is H. St. John Maule, Esq., 1, Wood-street, Bath, from whom further particulars may be obtained. I shall also be happy to give any explanation which may be required, as far as my time permits.—I am, &c.,

THOMAS DYKE ACLAND, Jun.

To the Editor of the Journal of the Society of Arts.

Proceedings of Institutions.

Alton Mechanics' Institution.—The twenty-first annual report of this Institution for the year ending September 30th, 1858, gives a favourable report of its proceedings and shows that it has received a large amount of public sympathy and support. There have been added to the library 138 volumes by purchase, 11 presented, and 3 from the Society of Arts. The total number now amounts to 1,463. The number of books issued has been 2,679. The lectures of the lost season were delivered in the following order: An opening lecture, on "Social Progress," by C. M. Burnett, M.D."; on "British Monumental Memorials," by the Rev. C. Boutell; on "India, Past and Present," by the Rev. F. M. Cunningham; on "Mind," by the Rev. John Banister; two on "Astronomy," by W. P. Snell, Esq.; on "The Present Time," by the Rev. J. D. Snow; on "Martin Chuzzlewit," by Mr. G. Grossmith; two on "The Atmosphere," by Mr F. W. Crowley; two on "Glaciers, Icebergs, and the Philosophy of Natural Scenery," by J. W. Curtis, M.D.; a Shaksperian declamation, "Hamlet," by Mr. A. Francis; a musical entertainment "Melodies of Many Lands," by Mr, G. A. Cooper; on "Electricity," by Mr. Bryant; "Macbeth," a reading, by L. Leslie, M.D.; an exhibition of dissolving views, by Mr. Steward; a lecture on "National Characteristics," by Mr. Stewart. These were, almost without exception, well-attended, and all which required it were beautifully illustrated. A large proportion of them, and many of the most popular, were given by members of the Institution. The fourth soirée of the Institution was held at the Town Hall, on the 8th of April, upon which occasion somewhat more than the usual amount of interest was excited. This arose partly from the opportunity being taken of presentsenting a service of plate to the President, which had been purchased by a subscription, amounting to about sixty guineas, raised almost encirely by members of the Institution. The museum report, sent in by the curator, states that the additions made during the past year are sufficient to show that there is no diminution in the interest taken in the museum by the friends of the Institution. These additions consist almost entirely of presentations either of objects entirely new, or of such as have been previously only exhibited. These embrace mammals, birds, reptiles, insects, plants, minerals, coins, &c., to the extent of about 350 specimens. The entire number of doners amounts to 41. The meetings of the natural history class were kept up during the winter. The first evening was occupied by a description of the specimens recently added to the collections—after which 15 familiar lectures on Geology were delivered by Mr. W. T. Gunner, and five on Reptiles by Dr. Curtis. The secretary of the music class reports that the class is progressing favourably. The number of members is 19, and of hon. subscribers 21. Since the committee put into circulation a prospectus of evening classes for elementary instruction, it has been ascertained that the time for holding them must be later in the evening—it is therefore now announced that the committee are desirous of fixing whatever time is found best to suit the convenience of those who are intending to enter the classes. It appears also to be generally felt that the age of admission should be fixed as low as thirteen years; the scheme would not then, it is thought, interfere with the public schools, and it is of great importance that the classes should be open to receive young men immediately on their leaving school. The balance on the building fund account against the Institution was, in the last report, £23 14s. 6d. The number of subscribers amounts to 276, viz., annual subscribers of ten shillings, 52; ditto, of one guinea, 51; quarterly subscribers, 134, ditto, who have paid part of the year and have left, 39. Six members of the Institution presented themselves for examination by the Hants and Wilts Adult Education Society. Of these five obtained a certificate, and one of them also a prize of books.

Wenlock Agricultural Reading Society.—The annual meeting of this society was held on Thursday, the 21st of October. Sir George Harnage, Bart., occupied the chair, and there were present the Rev. R. H. G. More, Messrs. Blakeway, G. Burd (treasurer), W. P. Brookes, (the honorary secretary), A. G. Brookes, H. Phillips, &c. Mr. W. P. Brookes read the report of the committee, which states that the progress of the Institution hitherto has been satisfactory, but the committee suggest that some material improvement be made in the management of the the lending library, to which, however, the number of subscribers during the past year, shows an increase, as compared with the preceding year, of 17 subscribers to the library and 7 to the reading-room. A long list of presents is given in the report, consisting of books, photographs, prints, autographs, fossils, &c. The following lectures have been delivered: On "Roads and Railroads," by the Rev. J. Hayes, Coalbrookdale; on "George Herbert and his Poetry," by the Hon. and Rev. Orlando Forester; on "The Life of Washington," by the Rev. N. Heywood; on "America," by John Evans, Esq., member of the American bar. With regard to the drawing class, the Government inspector, Mr. Wylde, visited the borough of Wenlock schools, in April last, for the purpose of examining the students for the year ending December 4th last. An exhibition of the works of the students of all the borough schools took place at Coalbrookdale. Eleven bronze local medals were awarded, of which four were gained by students of the Wenlock school. Prizes for free-hand drawing (first grade), were awarded to two National school pupils, who gained the prizes for drawing awarded by the Olympian class, in 1857, and eight students received prizes of the second grade. At the general exhibition of the works of students at South Kensington, in May last, a national medallion was awarded to a student of the Wenlock school. The number of students that entered during the year was 30, but the average of attendance was only 21, whilst the average last year was 33; consequently there has been a falling off of 12 students. The committee congratulate the members on the increasing success of the Olympian class. The usual prizes for useful, intellectual, and industrial attainments were distributed at the last annual meeting. The prize for drawing, viz., two years' free instruction in the Wenlock school of art and six shillings for the purchase of drawing materials, was awarded to Thomas Edwards. The Olympian class will continue the free instruction a year longer, should the student at the end of his second year gain a government local medal. The introduction of tilting at the ring at the meeting for competition in athletic exercises, added greatly to the interest of the spectacle; and the spirit and skill with which the prize, kindly given by the mayor, C. F. Ferriday, Esq., was contested for, gave general satisfaction. Prizes of £5 each for the first, and of £1 for the second, for these matches, and a prize of £1 for the best poetry on the Wenlock Olympian games, will be given next year. R. Jasper More, Esq., of Linley-hall, has offered to give "£5 as a prize for the best essay on physical recreations —ancient and modern—their moral and political value." The committee hope, through the kindness of one of the neighbouring landed proprietors, to obtain a piece of ground, so as to open a gymnasium in connexion with the Institution. The subscriptions to the Olympian class amounted to £34 2s. 8d.; the number of subscribers during the last year was upwards of 300. The philharmonic class consists of 20 members, paying each only 6d. per quarter. They meet once a week for the practice of vocal music. Several young men having expressed a wish to acquire some information in chemistry and botany, which are included in the examination scheme of the Society of Arts, a subscription was commenced for the purchase of a small chemical apparatus and of chemical and botanical diagrams. £23 3s. has been contributed and has been expended in the purchase of apparatus, chemicals, diagrams, &c. Arrangements will shortly be made for the meeting of the chemistry class. The following is a statistical summary of the report:—Subscriptions to the lending library, 87; ditto to the reading-room, 40; ditto the drawing class, 30; ditto to the philharmonic class, 20; ditto to the Olympian class, 305; ditto to the working men's branch, 30; total 512. Number of volumes belonging to the agricultural reading society, 1750; ditto belonging to the working men's branch, 254; total number, 2004. The treasurer's report showed—receipts, £66 19s. 6d.; expenditure, £77 11s. 6d., the balance against the society being £10 12s. After the adoption of the report, a vote of thanks was passed to Mr. Jasper More, for his offer of a prize, as detailed in the report, as well as for his contribution to the library. Some discussion took place in reference to the arrangements of the library, and the election of officers took place. Mr. Blakeway then paid a high compliment to Mr. Brookes, "their indefatigable secretary," and proposed that he be requested to continue the duties of the office for another year;—this was seconded by Mr. Fowler, and cordially adopted. Mr. Brookes acknowledged the compliment, and proposed that Mr. Burd be again requested to act as treasurer. This was also unanimously agreed to; a vote of thanks to Mr. A. Yardley, the librarian, was then adopted, and the proceedings closed with the usual compliment to the chairman. The annual dinner took place at the "Falcon Inn," at half-past three o'clock, under the presidency of Sir George Harnage, Bart.; the vice-chairs being occupied by W. P. Brookes, Esq., and Mr. Owen, the president of the Working Men's Institute. About sixty-four gentlemen were present.

Wigan Mechanics' Institute.—The fifth annual soirée of this Institution was held on Wednesday evening, October 27th, the Right Hon. E. Cardwell, M.P., presiding. Amongst those present were, Henry Woods, Esq., M.P. for the borough; Colonel the Hon. James Lindsay; N. Macleod, Esq., Secretary of the Department of Science and Art; R. Rumney, Esq., Manchester; J. Acton, Esq.; J. Ingram, Esq.; Edmund Clarke, Esq.; W. Peace, Esq.; M. Peace, Esq.; Rev. D. Blythe; R. Laing, Esq., &c., &c. Mr. Joseph Ingram, chairman of the directors, read the report. The number of members at present on the books are:—One member at £10; one at £5; one at £3 3s.; 114 at £1 1s.; 216 at 10s.; ten at 5s.; eighteen nominated by the donors of coal; in all 361, or 66 more than in the corresponding quarter of 1856. The directors desire to notice one circumstance which is very injurious to the pecuniary interests of the Institution. During the summer months, while all the expenses are as great as during the winter ones, many of the members cease to subscribe, so that the deficiency, made up of sums trifling to the individuals, is large in the aggregate, and causes a serious loss. Considerable improvements have been made in the accommodation, which are likely to increase the comforts of members. All the books in the library have been classified and arranged in a more convenient form, and the sum of £5, presented by the Right Hon. Lord Lindsay, and of £10, presented by F. S. Powell, Esq., have been expended in the purchase of 120 volumes. There are now 2,100 volumes in the library. The following is an account of the books, arranged according to their classes, which have been taken out since the re-opening of the library, on the 19th of July, to the 30th of September—a period of two months and a half:—of class A, or novels, romances, and tales, 869; of class B, or dictionaries and encyclopædias, 11; of class C, or fine arts, 21; of class D, or mathematics, &c., 12; of class E, or miscellaneous works, 110; of class F, or natural and experimental philosophy, 69; of class G, or natural history, 76; of class H, or biography, history, and geography, 239; of class I, or periodicals, reviews, and magazines, 201; of class J, or poetical works, 20; of class K, or voyages, travels and adventures, 168; of class P, or parliamentary reports, 4; in all, 1,850 volumes, which, added to the 3,023 volumes given out from the first of January to the 29th of May, at which time the library was closed for a month, gives a total of 4,873 volumes—being at the rate of 650 volumes per month; and when compared with the issue of 1856, there is in favour of the present year an increase of no less than 1215—*i.e.*, an average increase of 136 per month. The present number of pupils in the elementary classes is 70, the average attendance being 48. The mathematical class is still conducted with the same success as in former years. Another class for geometry has lately been opened, under the superintendence of one of the directors. The French classes are also in operation. Other necessary classes will be formed as soon as there seems a prospect of a sufficient attendance to reward the gratuitous services of those who are now willing and competent to undertake them. In order to promote the success of these classes, F. S. Powell, Esq., M.P., presented prizes to the amount of £10 to the successful candidates at the annual examination, and he has promised to do the same this year. Three lectures have been given this year; one by F. S. Powell, Esq., M.P., entitled "Recollections of a recent Visit to Rome and Naples; F. Hudson, Esq., of Manchester, delivered another on "The Chemistry of our Homes," R. Laing, Esq., meeting the expenses connected with the supply of the lecturer; Mr. Birkenhead delivered a third, upon "What we eat, and Why we eat." The financial position of the Institute is not very satisfactory. Many extra expenses, have, however been incurred, and notwithstanding its present financial position, the directors feel confident that the Institution is progressing favourably. Maskell Peace, Esq., read the report of the Mining and Mechanical School. It stated that on the 2nd of August last, a free lecture was given by Mr. Birkenhead, when the opening of the school was publicly announced. A valuable collection of chemical apparatus and mechanical models was ordered by the committee, and the school was opened on the 9th of August. The classes have regularly met since then, on Monday, Wednesday, and Friday evenings, for two hours each night, and the subjects taught have been chemistry, mechanics, and geology. The average weekly attendance has been fifteen. The finances of the school are in good condition. The meeting was afterwards addressed, at considerable length, by the chairman, as well as by R. Rumney, Esq., of Manchester, Henry Woods, Esq., M.P., M. Macleod, Esq., and other gentlemen, and separated after the usual compliments to the chairman.

MEETINGS FOR THE ENSUING WEEK.

Mon.......Medical, 8.
Tues. ...Statistical, 8. 1. Mr. Fox, "On the Vital Statistics of the Society of Friends.', 2. Mr. Danson, "On a Method of Relieving the Density of Town Population."
Civil Engineers, 8. Discussion upon Mr. Scott's paper, "Description of a Breakwater at the Port of Blyth, &c."
Pathological, 8.
Wed. ...London Institution, 3. Mr. T. Rymer Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Society of Arts, 8. Mr. Leonard Wray, "On Cotton Culture and Preparation in the United States."
Microscopical, 8.
Thurs....London Inst., 7. Dr. S. Frankland, "On the Air and Water of Towns."
Numismatic, 7.
Antiquaries, 8.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December* 10, 1858.]

Dated 30th August, 1858.

1956. F. Brignoles, 58, Torrington-square—Imp. in apparatus for the disinfection and rectification of bad tasted alcohols, by the separation of the essential oils from the alcoholic exhalations (A com.)

Dated 9th November, 1858.

2502. E. E. Allen, Brompton-row—Improved machinery or apparatuses for working the propellers of vessels.

Dated 12th November, 1858.

2540, J. G. Martien, Ampthill-square—Imp. in the manufacture of iron, and in the apparatus employed in such manufacture.

Dated 19th November, 1858.

2610. P, Marchand, E. Marchand, and J. Marchand, Dunkirk, France—A new process for refining lamp oil.
2612. W. S. Hayward, Wittenham House, Abingdon—Imp. in the manufacture of a glutinous and viscous substance or dextrine, to be used in the manufacture of paper, and in dressing textile fabrics, by which greater tenaciousness, smoothness of surface, and body is obtained.
2614. S. C. Leech and J. Leech, Manchester—Certain imp. in the construction of 'self-acting temples,' to be employed in looms for weaving.
2616. W. Hancock, Upper Chadwell-street—Imp. in the manufacture of electric telegraph wires and cables.
2618. H. H. Henson, 38, Parliament-street—Imp. in waterproofing fabrics or materials.
2620. E. A. Pontifex, Shoe-lane—Imp. in external surface condensers.
2622. W. Clark, 53, Chancery-lane—Imp. in purifying natural phosphates of lime. (A com.)
2624. J. E. F. Luedeke, Chipping Norton, Oxfordshire—Imp. in motive power engines.
2628. J. Easton, sen., and C. E. Amos, The Grove, Southwark—Improved apparatus applicable to drains, sewers, and watercourses, for the purpose of removing extraneous solid matters therefrom.
2630. T. S. Cressey, High-street, Homerton—Imp. in machinery used in the manufacture of casks.

Dated 20th November, 1858.

2632. J. Wadsworth, Salford—Imp. in gas burners, and in the means or methods of and in apparatus for moderating or retarding, regulating, or governing the flow and pressure of gas used for purposes of illumination, and in street lamps or lanterns for shielding flame from the action of wind and rain.
2634. D. Rowan, and S. Robertson, Greenock—Imp. in steam-engines.
2636. C. Tomlinson, Worcester-street, Wolverhampton—Imp. in stop taps or valves.
2640. H. Jordan, Liverpool—Imp. applicable to navigable vessels.
2642. L. Percivall, Birmingham, and J. Houghton, Edgbaston, Warwickshire—Imp. in attaching knobs of glass, china, and earthenware, to the spindles of locks and latches, and to doors, drawers, and other articles.
2644. H. Swan, 5, Bishopgate without—Imp. in stereoscopes and other optical instruments, and in stands or supports for stereoscopes.
2646. H. Gardiner, New York, U.S.—Imp. in the compound axle hub and wheel for railroad cars.

Dated 22nd November, 1858.

2648. R. Nelson, New York, U.S.—Imp. in apparatus for raising and lifting water and other liquids.
2650. S. W. Johnson and J. Varley, Peterborough—Imp. in pressure and vacuum gauges.
2652. E. H. Bentall, Heybridge, Essex—An imp. in the construction of turnip cutters.

Dated 23rd November, 1858.

2654. W. Ralston, Manchester—Imp. in embossing and finishing woven fabrics, and in the machinery or apparatus employed therein.
2655. W. H. Dawes, Bromford Iron Works, West Bromwich, Staffordshire—An imp. in forge hammers, and in the anvils used with forge hammers and squeezers.
2656. W. Gorman, Glasgow—Imp. in furnaces, and in the combustion of fuel, and in apparatus connected therewith.
2657. J. Fairweather, Dundee, N.B.—Imp. in weaving bags, sacks, and other tubular fabrics.
2658. N. F. Boréiko de Chodzko, Paris—A smoke preventing apparatus.
2659. V. Newton, 66, Chancery-lane—Imp. in retorts for generating illuminating gas. (A com.)
2660. V. Newton, 66, Chancery-lane—Improved machinery for sweeping floors. (A com.)
2661. W. Warne, J. A. Jaques, and J. A. Fanshawe, Tottenham—An improved fabric, applicable for covering floors and walls and for other analogous purposes.

Dated 24th November, 1858.

2662. R. H. Hughes, Hatton-garden—Imp. in means or apparatus employed when lighting by gas.
2663. R. A. Brooman, 166, Fleet-street—An imp. in cigar cases. (A com.)
2664. Sir Charles Shaw, Old Cavendish-street—Imp. in the construction of ball and bullet proof shields or mantlets.
2665. W. E. Newton, 66, Chancery-lane—Imp. in mills for grinding corn. (A com.)
2666. A. V. Newton, 66, Chancery-lane—Improved machinery for making bolts and rivets. (A com.)
2657. R. H. Hess, Islington—A new manufacture of articles, parts of articles, parts of machinery, surfaces, and ornamental works from talc and other silicates of magnesia.
2668. C. Peterson, Lowcliffe-lodge, Isle of Wight—Imp. in the manufacture of paper cartridges, and in paper applicable for waterproof purposes.
2669. J. S. Nibbs, Aston, Warwickshire—Imp. in lighting, heating, and ventilating.
2670. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the employment of electricity as a motive power. (A com.)

Dated 25th November, 1858.

2671. C. E. Amos, the Grove, Southwark—Improved apparatus for raising and supporting ships or vessels while undergoing repair, which apparatus is also applicable for facilitating the passage of ships or vessels over bars, sandbanks, or in shallow waters.
2672. F. C. Calvert and C. Lowe, Manchester—Imp. in the manufacture of size.
2673. H. Eastwood, Elland, near Halifax—Imp. in purifying gas for illuminating purposes.
2674. R. Bodmer, 2, Thavies-inn, Holborn—Imp. in valves for regulating the supply of steam. (A com.)
2676. C. F. Vasserot, 45, Essex-street, Strand—An improved petticoat and bustle. (A com.)
2677. J. Nuttall, Old Accrington, G. Riding, Clayton-le-Moors, and W. Coulthurst, Old Accrington—Imp. in sizes for sizeing cotton linen or other warps or yarns for weaving.
2678. F. H. Maberly, Stowmarket, Suffolk—Imp. in candlesticks.
2679. C. Parker, Dundee—Imp. in looms for weaving.
2680. F. Loos, Mercer-street, Long-acre—Imp. in gas regulators.
2681. C. Mather, Salford—An improved steam trap or apparatus for allowing the escape of water and air from pipes, vessels, or chambers heated by steam.
2682. W. Burton, Bethnal-green—Imp. in preparing colouring matter for dyeing.

Dated 26th November, 1858.

2683. J. Luis, 1B, Welbeck-street, Cavendish-square—A new sort of drawers or trousers for ladies or children. (A com.)
2685. E. Dixon and J. Fisher, Wolverhampton—An imp. in the manufacture of welded iron tubes.
2687. M. Meyers, 9, Great Alie-street, Goodman's-fields—Imp. in parasols.
2689. G. Richardson, 1, New Broad-street—Imp. in machinery or apparatus for pressing bales of goods. (A com.)
2691. J. B. Booth, Preston—Imp. in machinery or apparatus for preparing, spinning, doubling, and winding cotton and other fibrous materials.
2693. P. Griffiths and J. Brennand, Burnley, Lancashire—Imp. in lubricators for introducing lubricating matter into steam cylinders and other chambers or parts under pressure.

Dated 27th November, 1858.

2695. J. Tangye, Birmingham—An imp. in hydraulic presses.
2697. G. Collier, Halifax—Imp. in means or apparatus employed in weaving.
2699. F. C. Kinnear, Hoxton, and D. Posener, Windmill-street, Haymarket—Imp. in the means of preserving life and property in navigation.
2701. C. Burrell, Thetford—Imp. in traction engines and carriages.
2703. W. Tillie, Londonderry, Ireland—An imp. in the manufacture of shirts and shirt fronts.
2705. H. Gerner, 2, Garway-road, Bayswater—Imp. in the mode of and apparatus for manufacturing gas for illumination and heating.

Dated 29th November, 1858.

2707. G. Oates, Gatefield Works, Sheffield—Imp. in the manufacture of scissors. (A com.)
2709. F. S. Perrare-Michal, 20, Rue de la Chaussée d'Antin, Paris—Imp. in the manufacture of bridles (without bits and without curb-chains) for riding, driving, or otherwise conducting horses.
2711. W. E. Newton, 66, Chancery-lane—Improved expansion or cut-off gear, for steam-engines. (A com.)
2713. W. Parsons, Bittern, near Southampton—Doing away with the smell arising from the melting fat, tallow, &c., and also for an improvement in stirring and straining the same.
2715. J. Lea and W. A. Sherring, Cecil-court, St. Martin's-lane—Imp. in the treatment of vegetable fibres for the manufacture of paper, spinning, and other purposes.
2717. J. H. Johnson, 47, Lincoln's-inn-fields, Imp. in locomotive engines. (A com.)
2719. L. A. Normandy, jun., 67, Judd-street, Brunswick-square—Imp. in manufacturing files. (A com.)
2721. J. Gresham, Hull—Imp. in apparatus for preserving ship's papers, and other papers and writings, in case of the loss of, or accident to, a ship whilst at sea.
2723. D. Evans, Chobham cottages, New Town, Stratford, and G. Jones, Charlotte-place, Upper Kennington-lane—Imp. in pumps and water gauges.

Dated 30th November, 1858.

2725, J. Luis, 1B, Welbeck-street, Cavendish-square—A new railroad with continued supports splintered together without any wood being used. (A com.)
2727. A Marks, London-wall—Imp. in the manufacture of braided articles.
2729. J. Thow, and T. Hall, Preston—Preventing the fusion of the fire-bars in locomotive or other furnaces.
2731. G. Boccius, Totnes, Devonshire—Imp. in the construction of furnaces.
2733. J. Colyer, Leman-street—Imp. in machinery and apparatus for cutting and shaping staves and other parts of casks.

Dated December 1st, 1858.

2735. A. Stenger, 4, Gresham-street—Imp. in the manufacture of cravats, braces, belts, and waistbands.
2737. J. Loach and J. Cox, Birmingham—Certain imp. in ornamenting the surfaces of japanned goods, and which said imp. are also applicable to the ornamenting of certain other surfaces.
2799. T. P. Purssglove, Battersea—Au improved pressure gauge for steam, gas, or other fluids.
2741. C. F. Vasserot, 45, Essex-street, Strand—An apparatus for printing with different colours thread, to be applied to tha manufacture of textile fabrics. (A com.)
2743. E. Viney, Cornhill—An imp. in the construction of portmanteaus, desks, dressing-cases, despatch-boxes, and other like articles.
2745. F. Warner, Jewin-street, J. Derbyshire, Longton, and A. Mann, Little Britain—An imp. in the manufacture of cocks or taps.
2747. H. Bessemer, 4, Queen-street-place, New Cannon-street—Imp. in railway and other wheels and wheel tyres.
2749. A. E. Davis, 1, Pulboro'-place, Harleyford-road, Vauxhall, and R. Wright, 28, Grosvenor-park, Camberwell—Imp. in the manufacture of colouring matter for spirits and other liquids.
2751. L. Bissell, New York, U.S.—Imp. in trucks for locomotive engines.
2753. E. L. Benzon, Sheffield—The manufacture of useful alloys of aluminium. (A com.)

Invention with Complete Specifications Filed.

2809. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved apparatus for ascertaining and registering the work of certain kinds of lever balances. (A com.)—7th December, 1858.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Dec.* 10, 1858.]

December 10th.
1325. J. Gemmell.
1353. W. P. Wilkins.
1391. H. Becu.
1433. C. Nightingale.
1439. P. M. Crane.
1477. W. Clark.
1486. E. Lord.
1488. A. V. Newton.
1911. M. R. Pilon.
2177. L. Cecconi.
2268. W. E. Newton.
2284. J. Braby & J. Braby, jun.

[*From Gazette, Dec.* 14, 1857.]

December 14th.
1342. H. J. Daniell.
1344. G. Neall.
1348. C. C. J. Guffroy.
1354. Sir F. C. Knowles.
1355. H. S. Warner.
1361. C. W. Lancaster.
1363. J. J. Cregeen.
1364. J. H. Dickson.
1419. R. Armstrong.
1574. G. Buchanan.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, Dec.* 10, 1858.]

December 6th.
2768. H. Bessemer.
2781. J. Cocker.
2785. P. A. le Comte de Fontainemoreau.

December 8th.
2796. J. Cliff.

[*From Gazette, Dec.* 14, 1858.]

December 9th.
2792. J. E. De Malbec.
2847. J. L. Jeffree.

December 10th.
2797. J. H. Johnson.
2820. J. H. Johnson.
2821. J. H. Johnson.

Journal of the Society of Arts.

FRIDAY, DECEMBER 24, 1858.

NOTICE TO INSTITUTIONS.

The following letters have been addressed to the Secretaries of the Institutions in Union with the Society :—

Society for the Encouragement of Arts, Manufactures, and
Commerce, Adelphi, London, W.C.,
17th December, 1858.

Sir,—The terms on which the Institutions are admitted into Union with this Society have recently been under the consideration of the Council, with a view to ascertain whether such alterations could be made as would enable the smaller Institutions to avail themselves at least of the advantages of the Society's Examinations, if not also of all the benefits of the Union.

Having considered all the suggestions and returns which have been received from the Institutions, the Council concluded that the best mode of dealing with the subject at the present time would be to pass the following resolution, which was unanimously agreed to, viz., "That at the Examinations of 1859, the Provincial Unions in Union with the Society of Arts may have the privilege of introducing Candidates belonging to smaller Institutes in Union with such Provincial Unions, but not in direct Union with the Society of Arts, provided that a fee of two shillings and sixpence be paid to the Society of Arts by the Provincial Union in respect of each candidate so admitted, and that the privilege be not exercised in favour of any Institute that has more than 50 members, or an annual income of more than £50."

Under this resolution, no small Institution in any Provincial Union connected with the Society need be excluded in 1859 from the Society's Final Examinations.

Wherever such a Provincial Union exists, the small Institutions can join it. Where no such Union exists, the Institutions, large and small, are recommended to form themselves into a Union, and to connect it with the Society of Arts. The Society has always recommended the Institutions in Union with the Society to group themselves also into smaller Local Unions, for the purposes of mutual co-operation, which is important for their welfare and efficiency. I am, Sir,

Your obedient Servant,
P. LE NEVE FOSTER, Secretary.

Society for the Encouragement of Arts, Manufactures, and
Commerce, Adelphi, London, W.C.
20th December, 1858.

Sir,—I have sent by this post a copy of the Programme of the Society's Examinations for 1859, in which is embodied the recent resolution of the Council in reference to the admission of Candidates from the smaller Institutes, of which I informed you in my letter of the 17th instant.

The Council would be glad to be informed what number of candidates you think it probable may come up for Examination in 1859, and whether satisfactory arrangements are made for the appointment and action of a Local Board of Examiners.

It is important that, while the Local Boards are not unnecessarily multiplied in any locality, one should be formed within easy distance of every Institute that has Candidates for Examination.

The Council will be obliged if you will furnish me, as soon as possible, with the names and addresses of the members of your Local Board, and with a statement of its title and locality. It is important that the Christian and surname, and exact address, of the Secretary of the Board, together with information whether it is to act for any other Institute besides your own, should be supplied.

I am, Sir, your obedient Servant,
P. LE NEVE FOSTER, Secretary.

A copy of the Programme of the Society's Examinations accompanied the foregoing letter.

The Committee of the Society for the Diffusion of Pure Literature have granted to the Council of the Society of Arts the privilege of giving recommendations to the Institutions in Union, enabling them to obtain at half-price libraries of £5 worth and upwards of books, to be selected from a catalogue issued by the Society, and which will be supplied to any Institution applying for it. The principal objects of the Society are to promote the circulation of such books, periodicals, prints, diagrams, and other publications as the Committee may, from time to time, deem really useful and good, whether they are issued by individuals or by Societies.

Institutions desiring to avail themselves of this privilege, should communicate with the Secretary of the Society of Arts.

SIXTH ORDINARY MEETING.

Wednesday, Dec. 22, 1858.

The Sixth Ordinary Meeting of the One Hundred and Fifth Session, was held on Wednesday, the 22nd inst., Thomas Clegg, Esq., of Manchester, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bower, Arthur Perry
Hacket, Charles A.
Mollett, John
Phillips, John Arthur

The Paper read was—

THE CULTURE AND PREPARATION OF COTTON IN THE UNITED STATES OF AMERICA, &c.

By Leonard Wray.

Statistics inform us that the annual consumption of cotton in Great Britain amounts to about 2,300,000 bales, weighing in all 920,000,000 lbs.

This vast quantity of the raw material keeps our numerous cotton manufactories in the proud and enviable position which they occupy, giving employment to so large a proportion of our population, furnishing cargoes to the merchant shipping of the world, and rendering almost every country on earth tributary to the industry, skill, and enterprise of our British "cotton lords" and their admirable artizans.

A great national industry, such as this, creates not unnaturally, unbounded jealousy in rival nations towards our country; whilst amongst ourselves, there is undoubtedly an increasing anxiety lest from any cause an adequate supply of this important staple product should not be obtainable. The bare possibility of this supply being suddenly cut off, and our cotton manufactories being thereby stopped, is indeed sufficient to create the most anxious alarm in every thinking man's mind in the United Kingdom.

Our cotton reports show that our own territories furnish us with only about one-eighth of the quantity employed by our manufacturers, whilst seven-eighths are supplied by the United States of America. Could we feel certain that no circumstances can ever arise to interrupt this vast supply from America, this country might, to a certain extent, be excused for viewing the subject with indifference, but common sense, and the experience of all time, unhappily forbid our entertaining a confidence for which we have so slight a warrant.

To say the least of it, even the bare probability of such an event constitutes a perpetual menace to this country, and imperatively demands a remedy and a safeguard. Fortunately, men of the right stamp are daily becoming more and more alive to the vital importance of this subject, and are bestirring themselves to render the supply of cotton to our factories more dependent upon our own exertions, and less upon the necessities or goodwill of our friends and cousins in the New World.

The course which is the most obvious, and which is indeed the only one we can reasonably pursue, is that now entered upon by these Manchester gentlemen, viz., the encouragement of cotton culture in the numerous colonial possessions of Britain—in the negro territories on the west coast of Africa—and in other suitable localities.

The production of cotton in the British possessions has been confined almost wholly to India; and that it admits of enormous extension in that noble country, everyone acquainted with the subject must be fully aware; but attention has also been forcibly attracted to the peculiar capabilities of our Australian, African, and other colonies, for the production of the same article; and every exertion will no doubt be made to obtain a certain supply from these sources.

The cultivation of cotton, however, is something quite new to the British colonist, and, indeed, I may say to the British nation altogether, inasmuch as the English have never yet seriously engaged in this important culture.

Hence we find in this country the greatest possible ignorance existing respecting the different kinds of cotton, the modes of cultivation, and its preparation for market. If we go outside the circle of cotton brokers, and make an inquiry on any of these points, we are told that absolutely nothing practical on the subject is generally known, but that we are sure to find something about it in some of the large encyclopædias.

Now, to any man who may meditate entering on this culture, or to any body of men who may desire to induce others to attempt this enterprise, such want of really practical information is a very great and serious obstacle, one which effectually frightens both the capitalist and the colonial planter. In the commencement of last year, I paid a visit to the United States, and became the guest of one of the great cotton planters in South Carolina, where I had the opportunity of seeing the methods pursued, both in that State and in Georgia, from the sowing of the seed to the pressing of the bales by steam power, prior to their shipment for New York, and for England.

I had seen cotton cultivated in India, and an attempt at cultivation in the colony of Natal; but here I was in the very heart of the cotton region of America, and I resolved to become master of the whole subject, in order that I might, at some future time, make my observations useful to the interests of my own country.

As an agriculturist myself, I was well aware, that to understand the subject thoroughly in all its bearings, it was necessary to study closely the whole question of labour; *id est*—slave labour as compared with the free labour, such as England commands in her various colonies. A fair comparison of these opposing conditions affords us a clearer conception of the chances which each system will have in the great struggle about to take place between them. Quite apart from the questions of climate, soil, and seasons, is that of labour; and it is one deserving the most attentive consideration, for on it mainly depends the pecuniary success of any attempt to grow cotton for the markets of the world.

My observations on all these points I will now endeavour to lay before the Society, hoping that they may prove interesting and useful to the country at large.

When we speak of the culture of cotton, it is necessary to understand most clearly, first of all, the great difference which exists between the long staple, or Sea Island cotton, and that known as short staple, or up-land Georgia; the former ranging in price from 10d. up to 5s. per lb.: whilst the latter commands only from 3d. to 10d. per lb., (these being the extreme ranges of price in the two descriptions of cotton): and secondly, the important fact that the cotton plant yields, besides its lint, other valuable products; viz., a pure, bland oil, equal to that of the olive; an oil-cake most excellent for feeding stock, and a fibre from the bark of the plants, which may probably become of great importance.

As it is very desirable that these auxiliary products should be borne in mind, I have mentioned them thus early, for in all calculations of produce from a cotton plantation they seem to have been almost entirely ignored hitherto, although I am not satisfied that, in many cases, they may not yield as large a money return to the planter as that from the cotton itself.

Even in the United States, which produces annually some 3,000,000 bales of cotton, it is very recently that the valuable character of the seeds has been partially turned to profitable account; hence we find that very very few planters have yet availed themselves of the pecuniary advantages derivable from this source.

It is generally calculated that short staple, or up-land cotton, yields from two to three pounds of seed to each pound of ginned cotton, or lint, whereas, long staple cotton gives a much greater proportion of seed. In the rich lands of Alabama, Mississippi, Louisiana, &c., the short staple seldom gives, on an average, less than three pounds to the pound of lint.

I ask particular attention to the following account, published in New Orleans last year, by Dr. Jenner Coxe, shewing that an increased value of more than £7,600,000 Sterling might be given to the cotton crop of the United States by utilizing the cotton seed, which is now almost wholly wasted.

The statement is by Mr. Woodall, confirmed by Mr. W. P. Converse and by Dr. Coxe himself.

"Average cotton crop of the United States three million bales, at 400lbs. per bale, will be of ginned cotton 1,200,000,000lbs. To each lb. of cotton there are 3lbs of seed,—3,600,000,000lbs.; retained for re-sowing, including waste, &c., 1,800,000,000lbs.; leaving, for making oil, oil-cake, and soap, 1,800,000,000lbs. 100 lbs. of cotton seed will yield two gallons of oil, equal to that of Italy termed "Salad oil;" and it sells in New Orleans at 4s. per gallon, whilst in New York it fetches 6s. per gallon); 48 lbs. of oil-cake, (equal or superior to linseed cake,) and $6\frac{1}{4}$lbs. of soap stock, which, with ingredients of small value, will make 20lbs. of soap equal to the best European kinds."

The following, then, is a moderate estimate :—

36,000,000 gallons of fine oil at 75 cents......	£5,400,000
864,000,000 lbs. of oil-cake at 1 cent	1,728,000
106,000,000 lbs. of soap stock at 3 cents	636,000
Total estimated value	£7,764,000
Or, allowing a deduction of one-third to satisfy all objections	2,588,000
Leaving a gross amount of	£5,176,000

It will be remarked that in this statement the value of the fibre obtainable from the bark of the plant itself has not even been mentioned, although, from the rough specimen which I hold in my hand, some opinion may be formed of the importance which this product may hereafter attain, seeing that there are certainly seven millions of acres now under cotton culture alone in the United States.

I think this brief allusion to these auxiliary products is sufficient to show that they should by no means be overlooked in estimating the returns from a cotton plantation in America or elsewhere.

The Culture and Preparation of Upland Cotton.

The American planter always prepares his land with the small plough usually drawn by one or two mules or horses, which are trained to walk very fast. The person holding the plough, being either a negro man, woman, or boy, who generally works the same animals every day, is responsible for their treatment, and teaches them to behave in the most docile and intelligent manner, whilst they themselves become exceedingly expert as ploughmen (or women as the case may be).

In many cases, in fact, I may say in the vast majority of cases, where the planter has to deal with poor soil, he infinitely prefers employing his land every other year, or every third year, rather than going to the trouble and expense of manuring it, nor does he, except in rare instances, take the least care of the fields lying fallow, consequently they generally present a picture of the utmost untidiness and neglect, covered with weeds, amongst which a few cattle strive to obtain a scanty picking.

The preparation of the lands commences in November, and continues until March and April, when the sowings take place.

The land having been ploughed and harrowed down, is then again ploughed and thrown into ridges or beds, from 2 to 2½ feet broad, the tops being neatly levelled or smoothed by a one horse implement termed a sweep.

The sowings are made as early in the season as the frosts will allow, in order to get all the land planted in good time, and to have the crop in as forward a state as possible. In this, however, there is always more or less risk, for late spring frosts may come and all the young plants may be cut off in a single night, entailing the necessity of resowing the whole of the fields. Thus, last year many planters in South Carolina, Georgia, and other states, had to re-sow as late as May. So very tender is the young cotton plant.

The manner of sowing the seed varies according to soil and locality, or according to the peculiar ideas of the planter; thus the distance of the rows, from centre to centre, ranges from three feet to four-and-a-half feet; whilst some deposit the seed in furrows opened by a light plough, and others carefully dibble in their seed at exact distances apart. This latter method is practised on the estate of my friend, the ex-Governor of South Carolina, where I chiefly resided, and this mode I will therefore more particularly describe, as he speaks in high terms of its superiority.

The beds having been formed, as above noticed, a gang of men (taking each a row) proceed rapidly along, striking their dibbles (so called) into the centre of the beds, at exact distances of 12 inches apart. A second gang (generally women) deposit five or six seeds in each hole or indentation made by the dibbles, and a third gang (generally young boys and girls) follow with light hoes and cover the seed with soil, thus completing the operation.

This may seem to many a very roundabout method of accomplishing this apparently simple matter, but it must be remembered that upland seeds are not only furred by the cotton lint still remaining on them, but they stick so together that their delivery, even by the most ingenious drilling machine, is held to be very uncertain and unsatisfactory. Moreover I can say, from actual experience, that the rapidity with which these trained negroes get through the work is something truly astonishing, and only to be appreciated by those who thoroughly understand such operations.

The seed being sown, the greatest possible care is taken to prevent the growth of weeds, for if these once get the upper hand, the crop is either seriously injured, or entirely destroyed; hence this is a pretty hard time for the negro labourers, who with light and sharp hoes, have to do unceasing battle with the enemy until the young plants have reached a certain size and strength. These weeding gangs also from time to time cut out the weakly plants, until at length only two, and these the strongest are left in each hole. Supplying, or re-sowing the holes that have failed to produce plants, likewise occupies attention.

It is always the object of the planter to perform as much of his work as possible by means of his horses, mules, ploughs, sweeps, &c., and as little as he can by mere hand labor; but the weeding of the very young and tender plants is an operation too delicate to be performed with any safety or nicety altogether by ploughs or sweeps; although I believe some "very smart" planters do occasionally boast that they never use such a thing as a hoe in their cotton-fields.

It is an undoubted fact, which I unhesitatingly vouch for, that the negroes in the Southern States are altogether unequalled in horse or mule husbandry; and I assert that the rapidity, efficiency, and the precision of their work, is infinitely beyond anything that is dreamed of in this country:—but we must well understand, that this excellence in work arises from the *unceasing training of a life-time*, under the watchful eye of those whose lessons are very sharp and striking, and who will listen to no excuses. They must work well, and they do.

It is usual in the States to calculate the crop at so many acres to the working "hand," (as the slave is denominated); thus a cotton planter with 50 good working hands (great and small) and 25 mules, would consider his strength equal to 500 acres of cotton, and 400 acres of corn, or to 1000 acres of cotton alone, provided extra hands were allowed to help in picking in the crop. This is the general mode and rate of calculation, where the soil yields about 200lbs. of ginned cotton to the acre; making therefore to the hand, 2000lbs. of cotton, which at 5d. per lb. on the spot, is worth about £40 sterling, besides the value of the Indian corn raised.

The whole cultivation of the cotton plant, up to the period of its first "picking," is termed "making the crop," therefore a planter will say "my crop is made, so that part of the business is over."

It must not, however, be supposed that crops arrive at this stage without very frequently encountering many and serious trials; on the contrary, the cotton plant has many enemies, such as the cut-worm, the army-worm, grasshoppers, &c., &c., whilst too much rain, or a long-continued drought, does it great injury; and certain moths deposit their eggs in the very young and tender bolls, which are thereby partially or wholly destroyed, and this sometimes occurs to an immense extent.

If the season has been forward and favourable, the "picking" may begin in August; but if backward, the first general picking may be delayed until September. In uncommon cases, in some districts it may begin as early as July; but whenever it does commence, the chief dread of the planter is an early frost; for until a killing frost does occur, the plants continue to produce and ripen their bolls.

During the picking season, as may be supposed, the utmost activity prevails, every available "hand" goes to the field; and the shorter the individual the less will his or her back be tried, for cotton picking generally is rather a back-aching employment.

Each picker takes a bag (tied round the breast or waist) and a good sized cotton sheet; the former he fills with the cotton he picks, which he then lays out on the latter to dry, whilst he is re-filling his bag, and so on until his sheet will hold no more, when he carries it to the weighing house, and returns for another lot.

A good careful hand will pick in a fair field 200lbs. of seed cotton in a day; but to accomplish this quantity, he or she must be a "right good hand," unless the cotton is unusually thick on the bushes. I have, however, heard it frequently affirmed, that in the teeming valley of the Missisippi, the hand not uncommonly picks from 400 to 500lbs. a day, but it must be killing work, and the cotton so picked must be very foul.

Successive pickings, each being less in quantity, at length so exhaust the cotton on the bushes, that there is no longer any left to pay for further picking; the cattle are then turned in and speedily destroy the bushes, and the land is left in this condition until required some succeeding year either for corn or cotton again.

In the valley of the Mississippi, the common average yield per acre of ginned cotton is one bale of 400lbs., whereas in South Carolina, Georgia, &c., 200lbs. is considered a very excellent return per acre, much of the land not giving even 100lbs. per acre.

There is, however, abundance of rich land in all these states, which will yield 400 lbs. to the acre; but being low lying, the cotton is liable to mildew, to be injured by wet, and to be killed by early frosts; whilst, at the same time, they are very unhealthy; hence such lands are preferred for corn and rice.

Some upland cotton plants, under favourable circumstances, are wonderfully prolific, producing from 300 to 400 bolls per tree, weighing 4½ lbs. of seed cotton, equal to about 1¼ lb. of ginned cotton. Indeed, intelligence has just reached me from the southern states that a planter at Oxford, in Georgia, has, by judicious management of his seed, succeeded this year in obtaining a plant which, although only 4½ feet high, ripened 420 bolls, yielding nearly 5 lbs. of seed cotton. From this it may be imagined how very greatly the produce per acre may be increased by a good selection of seed, and by a careful attention to the due preparation and manuring of the land, instead of having a large straggling cultivation, unmanured, and miserably neglected.

Picking cotton is no doubt considered by many to be a very easy and simple operation, but, in reality, to pick cotton properly is a very nice and delicate business, inasmuch as it is essential to withdraw every particle of cotton from the boll at one pull, without getting any leaf, scraps of leaves, or other foreign matter clinging to it. By dexterous management, so as to grasp lightly with the fingers the five sections comprising the boll, and withdraw at once all the cotton in it, the rapidity of the picking is insured; whereas, by making two, three, or four efforts, but a small quantity would be gathered in the day's work, and the unskilful hand would cut but a very sorry figure at the weighing house in the evening. By obtaining it free from small fragments of leaves and of the boll itself, the cotton is clean, and consequently entails little or no trouble in getting rid of these extraneous matters prior to being ginned.

Great rapidity and care are therefore qualities essential to form a good cotton picker, and the strictest supervision is exercised in enforcing them. Apart from all this, however, the pickers very frequently get sore hands in the picking season.

But the most annoying and distressing circumstance under which the "hands" labour, is the wetness of the bushes in the cold autumn mornings, caused by heavy dews at night. This wets the people's clothes, and often leads to colds, influenza, rheumatism, &c., which recently some planters have sought to remedy by providing waterproof aprons or skirts to be worn by the hands.

Wherever the strength of the estate will allow it, the hands are put to other occupations in the morning, until the sun has partially evaporated the moisture on the bushes and on the cotton, when they commence picking; but in the cold frosty mornings the sun only thaws the moisture, and the pickers generally get both wet and cold. There are numerous plantations, however, so pressed for time that the hands are kept at it dew or no dew; although the planter by no means likes it, for the cotton picked is in a very damp state, subjecting it to great deterioration; whilst the hands run great risk of sickness and death.

A comparatively dry season, with only a few showers now and then, is that most favourable for cotton picking, and that for which the planters most earnestly long.

Immediately a sufficient quantity has been picked and ginned, it is packed in bales (under considerable pressure) and sent into town, the planter being only too anxious to convert the first of his produce into money; thus, from the month of August, waggons are constantly on the road, loaded with the standard "currency" of the south, and, by November the crop should be all baled and sent to market, where, in general, it is sure to meet with a ready sale.

This facility of sale is the main reason for the planters clinging so tenaciously to the cultivation of cotton, for they always feel that, with a few bales of cotton in hand, they can obtain money at any moment by making the very smallest possible sacrifice, or perhaps without any sacrifice whatever.

Besides this, the culture is so well-understood by their hands, and the preparation of the cotton for market is so exceedingly simple. Indeed, this preparation consists merely in passing the seed cotton through the ginning machine to separate the seeds, and then pressing the lint into bales of about 400 lbs. each.

Two machines (costing each from £16 to £22) will gin a crop of from 300 to 500 bales, and the screw press, which costs only £30 to £50 when made on the plantation, is able to compress 30 bales a day.

I have spoken of short staple, or upland cotton, but it must be understood that there are endless varieties (so-termed) of short staple cotton, which it would be tedious and out of place for me to speak further of here; suffice it to say, that it is on the sea islands and sea-coasts alone that the long staple can be advantageously grown, whilst the short staple has the whole range of the vast interior of all the Southern States of the Union.

Before quitting the subject of short staple cotton, I wish to mention a particular description, which is grown in the island of Cuba, where it is chiefly used for making the wicks of lamps on sugar estates—being of a very coarse and inferior quality. The pods or bolls are, as will be seen from the specimen now in my hand, of enormous size; the plants grow into considerable-sized trees, attaining, very generally, a great age, and are remarkably prolific. I regard the cotton more in the light of a curiosity, for I do not, at present, see that any great commercial value can be attached to it, although we do not yet know what effect might be produced by crossing it with a finer description of the cotton plant.

Long Staple Cotton.

The long staple cotton which fell under my observation in the United States, is that commonly known as "sea island," from being generally grown on a multitude of small islands on the sea-coasts of South Carolina and Georgia; but now it is, I believe, extensively cultivated in Florida, Louisiana, and Texas also.

Removed any distance from the coast-line, this cotton, I am told, immediately degenerates, and becomes short in its staple and wretchedly poor in its yield; hence we may consider its only congenial locality as being the very shores of the sea.

The chief sea island region of South Carolina lies between Charleston and the great Savannah river, which separates that state from Georgia; and of this region, the island of Edisto has the reputation of producing the finest and most valuable.

The very small specimen now in my hand, was given me as being part of a bale the production of that island, which sold for one dollar and a quarter (rather more than five shillings) per lb. to a French buyer, for the purpose of being worked up into lace in France, and I heard of a small sample being at that time in Charleston which was valued by the best judges at one dollar and a half (more than six shillings) per lb.; but this was said to have been grown in Algeria from American seed.

It must be understood, however, that these prices, in America, are considered extremely high, and of most unusual occurrence, the more usual qualities and prices being much lower. Such extraordinary prices as these are scarcely to be wondered at, when we know that one lb. of this fine cotton has been spun into thread, 1,000 miles in length, which, when made into lace, has sold for upwards of £250.

I shall now proceed to touch on the culture and preparation as pursued on the sea islands.

The preparation of the land and the throwing up of the beds for the plants, very much depends upon the peculiar situation of the fields and the nature of the soil. The land may lie low and be very much impregnated with salt, from the occasional influx of a very high tide, or it may be somewhat swampy from a superabundance of fresh water; again, it may be a very light and sandy soil, or it may be a pretty stiff clay, or, varying from all these, it may be a nice warm loam, lying high and dry, above the influence either of tides or of freshets. According as these conditions vary, so, to a certain extent, does the practise of the planter. In low-lying lands, very light drainage alone is practicable, hence, when they are of a clay soil, they are liable to be, at all times, cold and trying to the plants, keeping them sickly in appearance and backward in their growth. In such cases it is usual to ridge very high, to plant thin or wide apart, and to give the warmest manures available. The spaces between the ridges act as so many superficial drains to carry off the superfluous water to the main drains. These ridges are mostly thrown up in the first place by means of suitable ploughs, and finished off by the hoe; and indeed, throughout the whole culture or "making of the crop," there is a great deal more hand-labour than there is on the upland plantations, and infinitely more care bestowed. On higher lying and drier lands, such heavy ridging is not required, although I remarked that the system of ridging is, to a certain extent, universal on all the Sea Island plantations.

In all their operations, horse or mule labour is always availed of, as far as possible, in order to abridge hand labour; but the very nature of this cultivation necessitates a recurrence to the human hand, to so great an extent as to limit very materially the quantity of land sown every year by each planter. The produce is so much more valuable than upland cotton, that 200 acres of the one, properly cultivated, will, on an average, represent in money value 1000 acres of the other, consequently, the sea-island planter can afford more time and more expensive labour than his brethren of the interior.

Notwithstanding this, there is not that amount of good and scientific cultivation apparent on these plantations generally, which, from the valuable description of the produce, a fastidious Englishman would expect to find. There can be no question that the fields planted in cotton are very clean and very carefully kept; but those lying fallow are covered with a profusion of tall weeds and troublesome grasses, which shed their seeds, and having impoverished the soil, leave behind them a legacy of labour and vexation to the planter.

I was so struck by this seeming folly, that I inquired of one of these gentlemen why he did not "green soil" these lands, instead of abandoning them to weeds and desolation. His answer was eminently characteristic of the state of feeling and state of things there existing. "It is very well for strangers to ask such questions, and to wonder that they do not see amongst us that high class condition of agriculture which is to be found in the north, and in England; but remember, my dear sir, that we, too, have our experiences, for which many of us have paid pretty dearly. Most of us have been established here upwards of 100 years, and have from time to time tried manuring, green soiling, clean fallows, and all the other methods pursued and recommended in England, but we have always found that with the soil and climate we have, and our negro labour, we succeed better by keeping to the system which seems so unthrifty to you. Besides, we have not sufficient labour, nor mules to plough up more land than we absolutely require each year to plant in cotton, corn, and sweet potatoes; so we content ourselves with giving to our land such manure as we can make and collect ourselves, and are only too happy at knowing that we are on the right side of the hedge, and not getting into debt and difficulties."

The experience of many years in various countries has taught me the presumption of despising any local practices which for many long years have proved successful, however opposed such practices may be to all my own ideas; still I think that, were I a Sea-island cotton planter, I should try what might be accomplished by a change of system.

Great numbers of these island plantations have large stores of manure, in the shape of rotten reeds, flags, marsh, grass, &c., brought to their very fields by numerous intersecting rivers, creeks, &c., besides the quantities of rich, saline mud, intermingled with small shells, which they likewise furnish. Most planters avail themselves largely of this bounteous supply, and thereby add very greatly to the fertility of their lands, and of course to their return per acre. I was much astonished at the very saline character of the soil in which I saw much of this cotton thriving; and I think it quite worthy of note, that I saw in many places large tracts of land, which had, perhaps, but a year or two previously been quite covered by the salt water of one or more high tides, and which still retained so much saline matter as to be apparent even to the eye, but which were nevertheless covered with the most luxuriant growth of bearing cotton. I also saw other tracts quite denuded of all vegetation, save a few saline plants, and which appeared to be little better than a salt marsh, but to my surprise I learned that in a couple of years they, too, would be growing just as fine cotton as much that I had seen. I must confess I had no previous conception that this valuable cotton would even grow at all on such highly saline soils; and had I not seen it myself, I should have been somewhat incredulous of the fact. As it is, I do from actual experience vouch for it as undeniably true.

I cannot see any difficulty in sowing this description of cotton seed by means of a drilling machine, for the seeds are perfectly smooth, and consequently easy of delivery; in fact, many plantations always employ a machine, called a "cotton planter," which dispenses with the number of hands usually employed in dibbling on Upland plantations.

The sowings being effected, all the after operations in the field, such as weeding, moulding, banking, or ridging, are successively performed, entailing, as I before remarked, no inconsiderable amount of hand labour.

About July or August the picking commences, and continues until November generally, unless severe frosts occur earlier.

If rapidity and care are imperatively required in picking the short staple variety, it can well be imagined that extreme care and attention are demanded in gathering in the delicate and valuable "sea island." Rapidity of work is by no means so essential as great cleanness, for the object is to preserve the quality, and thereby maintain the established reputation of the particular plantation. Upon this reputation depends not only the price, but the very sale of the cotton, for it must be understood that this description of cotton, being employed only for particular purposes, does not meet, by any means, so ready a sale as the short staple; indeed, not unfrequently a planter cannot sell his crop at all, and is obliged to ship it to England at all risks.

Its picking, and every step in its preparation for market, receive, therefore, the utmost care and attention.

When it has been picked, the first object is to get rid of any superfluous moisture it may contain without drying it too much. It is then picked over, to get rid of all motes, and discoloured particles of cotton, which sometimes, from insects boring into the bolls, and from other causes, get mixed up with the mass.

This being satisfactorily performed, it is kept in heaps sometimes five feet high, four to five feet broad, and twenty feet long, and covered over with cloths. The object of this is to preserve the oiliness, strength and gloss of the fibre (which a lengthened exposure to the air would destroy), until an opportunity offers of selling it, or it is necessary to send it to market. But by thus keeping it in heaps, the liability to heat must be attentively watched and guarded against, for whenever it gets too warm, the heaps must be immediately opened out, and the cotton be carefully spread on the clean-swept floor of the cotton house, to be again replaced in heaps as soon as it has become perfectly cool. If the heaps become hot, in a very brief space of time the oil contained in the seeds oozes out on the fibre, and imparts to it a dirty yellow colour, which rapidly changes into a brown, and thus destroys its commercial value: but many planters do not object to its becoming very slightly heated, esteeming it an advantage rather than otherwise, inasmuch as they consider that the fibre extracts gradually some of the oil from the seeds, and thereby becomes stronger, softer, and more silky, whilst at the same time it acquires a very delicate shade of yellow, such as experienced buyers admire.

But the time has now arrived for separating the fibre from the seed, and here we become aware of a very remarkable fact—one which completely astonished me. I found that the machine chiefly used for this purpose was no other than the little, humble, and despised roller gin of India—the veritable *churka*.

This little implement consists of two wooden rollers, of about 8 to 9 inches long and one inch in diameter, placed horizontally and in contact, one above the other, and revolving together, drawing the fibre of the cotton through and leaving the seed behind. In Carolina the motion is communicated by a treddle, worked by the foot, whilst the feeding is by hand as in India.

By means of this little machine 12lbs. to 20lbs. of cotton are prepared in a day, and that is considered fair work; but my scientific and esteemed friend, Mr. Robert Chisolm, of Coosaw plantation, has applied steam power to give motion to all his roller-gins, or *churkas*, and this gets through a very great deal more work per hand daily.

So exceedingly sensitive however is the market for this peculiar description of cotton, and so cautious are the planters, that those who grow the very finest kinds will on no consideration deviate from the beaten track, nor employ any other machine than the little, simple, old-fashion churka, actuated by the treddle.

These gentlemen maintain that the rapid motion given by steam, not only heats the fibre, but strains and even breaks it.

This assertion Mr. Chisolm, on the other hand, utterly denies, and instances his own large crop, which always maintains the current prices. There is, however, another, and a totally different machine (known as "McCarthy's"), which is now coming into very extensive use amongst the growers of second and third-class Sea Island. One extensive planter (who has on his plantation eight of them worked by steam-power) told me that his cotton fetches the same price now that it did when he used the churkas, and so great is the advantage derived from their use, that he would rather abandon cotton cultivation altogether than go back to the use of the little fiddling roller-gins or churkas.

I must say that such an opinion, so emphatically expressed by a large planter of great experience, and perfectly disinterested, had very great weight in my mind, and I was pleased to find this opinion extensively confirmed afterwards. I have moreover heard gentlemen assert that they have prepared samples of the same quality by the roller-gin and some by McCarthy's machine, and then submitted them to all the first-class brokers in Charleston, none of whom could tell which was by the former, or which was by the latter; and this experiment they told me they had tried on the finest Edisto cottons with precisely the same result.

Now, I hold this to be important evidence for us in all our future operations, the more especially as one of these singular machines, steam driven, can turn out 500 lbs. of clean cotton per day. I have not ventured to speak of its performances in my own presence, for although I might do so as respects quantity, yet my eye is by far too inexperienced in this speciality to be a competent judge as to quality.

Machines precisely similar to these, but, I presume, smaller, are made in Manchester by Dunlop and Co., at from £7 to £10 each; whereas the large ones of South Carolina cost £20 to £24 each, including patent right; or £15 without the patent right.

There are several other kinds of machines in America for separating the seed from long staple cotton, all of which are very highly praised by their inventors, owners, and friends, but as I did not see them at work, and have no reliable evidence to offer respecting them, they must abide their time.

When the cotton has been cleared of its seeds, motes, and discolored particles, it is then pressed down very tightly into long round bags, quite different in form to the bales of Upland cotton; and it is never subjected to such great pressure as it would receive in a screw-press, for that would very seriously injure its fibre.

After his produce is all fairly bagged, the difficulties of the planter are not ended, but, as I said before, he has sometimes considerable trouble, and to wait a long time before he can find a buyer for it, and not unfrequently he has to ship it to Europe, and encounter all its manifold risks and chances.

This, indeed, constitutes the greatest disadvantage under which he labours. The Upland cotton planter makes his bale of cotton to-day, and to-morrow he has cash in hand for it; or perhaps he is even paid for it before it has left the trees: not so, however, with the Sea Island cotton planter, he is obliged to exercise all his patience before he can sell his crop, and in the meantime, although lord of 200 to 400 slaves and fine estates, he is very probably compelled to use his broker's name in obtaining cash from the banks wherewith to pay the current expenses of his estate.

It must strike every one as a singular feature in the banking system of Charleston, that a broker, who may be a mere man of straw, can get his bills cashed at the banks, whereas, those of a really substantial planter, owning large and most valuable properties would not be looked at; yet, such is the practice of these banks. I presume that there must be some good and sufficient reason for this, but I certainly failed in discovering it.

I have already stated that the Sea Island furnishes a larger proportion of seed then the Upland or Short Staple does; and I think we shall be correct in estimating it at four pounds of seed to one pound of fibre. These seeds are black, smooth, and clean, yielding a fine oil and excellent cake; whilst the bark of the plant furnishes a much better fibrous material than the Upland variety; this specimen being from a Sea Island plant.

It is necessary for me to remark also, that long staple cotton is not so prolific as the Upland varieties, consequently the quantity of cotton obtained from the acre is very much less.

200 lbs. of clean cotton seems to be the maximum, whilst some fields do not yield 40 lbs.; the hands therefore pick smaller quantities per day than on Upland plantations, and the picking seldom ceases until the trees are entirely stripped of their delicate and silken fibre.

Such, then, is Sea Island cotton planting; but I cannot take leave of these beautiful Sea Island plantations, without remarking upon the warm-hearted hospitality, unaffected kindness, nice sense of honour, and gentlemanly deportment of those proprietors with whom I had the pleasure of becoming acquainted during my visit to Beaufort and its neighbourhood in November 1857.

Provision Crops.

The general rule on cotton plantations of all kinds, is to cultivate a certain quantity of Indian corn, rice, &c., for the food of the white people, the negroes, the mules, horses, horned cattle, and other stock belonging to the estate; but some planters grow very large quantities for sale also. A friend with whom I resided, in addition to his cotton crop of 275 bales, gathered in whilst I was with him 61,000 bushels of corn, of which he would use on his plantations, about 11,000 bushels, leaving 50,000 bushels for sale.

It must be understood that most planters allow 3 lbs. of bacon a week to each negro on the plantations, man, woman, and child, besides corn meal, molasses, tobacco, &c.; consequently it is not uncommon to kill and cure 400 to 500 hogs every year on a plantation having 300 to 400 hands all told.

I knew one planter with about 600 hogs, and the quantity of corn this herd of swine would dispose of was no small item at the end of the year, but all "this hog" was for the use of the plantation only, none being sold.

This brief explanation renders clear the practice of growing such large quantities of corn on most cotton plantations; but I may add, that from a variety of causes, many of them exhaust their stock, and have to purchase from their neighbours, who may have been more fortunate or more provident.

Labour.

Having thus touched on all the subjects most interesting in the culture and preparation of cotton, it is now essential that I should submit to the society my views on that great, and I must say, little understood, question, viz., that of labour, such as the slave gives his master on the cotton plantations, and that which can be calculated on by Englishmen from the free men to be found in the colonial possessions of Britain.

In doing this, I beg to remark, that I shall endeavour to consider the subject in a strict business point of view, feeling convinced that a really practical and scientific body of men must always prefer dealing with plain facts and figures.

The money-value of an individual slave can only be arrived at from a due consideration of his, or her, age, health, strength, freedom from blemishes, temper, capabilities, &c., &c.; but working hands, of all sorts, sizes, and ages, on a plantation, may be fairly estimated as being, on an average, worth 800 dollars, about £165 sterling, each person.

Considering the liability of loss by death, or disabling by accident, I do not think £16 per annum, as interest, will be considered unreasonably high. Add to this the cost of food, clothing, medical attendance, and small allowances, which on every well ordered plantation amount at least to 40 dollars, or about £8 per annum, and we find that the real cost of slave labour is about £24 per annum.

I will vouch for the general accuracy of this calculation. Let us then take this sum as the cost of slave labour, and next inquire what kind of labour it is that the planter obtains for his money? To comprehend this thoroughly we must consider that from childhood, the slave is constantly under the eye, not only of his master, but likewise under that of men of his own class, named "drivers" who are selected for their intelligence, their trustiness, and their thorough knowledge of plantation work; each day brings with it its lesson, which he must learn, and each year finds him improving in his work, and becoming more and more capable in the various duties assigned him.

His master's plantation is to him at once a home and an industrial school, in which the reins of government are held pretty tightly; into which he enters in early boyhood, and continues, ever learning, until old age, sickness, or death removes him.

It must be remembered that whatever occupation he may be put to, he is obliged to learn it thoroughly and to perform it well. That self-same stimulant which is sometimes so vigorously applied in our schools to brighten the faculties of our English boys, is also resorted to on plantations, but with more method and more severity. One of the primary lessons inculcated on the mind of a juvenile "hand" is, that if he does not perform his work properly he will be whipped; and when he has once mastered this lesson, and becomes positively certain that a good whipping will inevitably follow bad work, he has already gained an experience which will save him from many flagellations. In short, he takes good care to avoid punishment if possible, and by so doing becomes a good and skilful labourer.

Now, this training goes on from day to day, and from year to year, without cessation and without the smallest relaxation of discipline: would it not be wonderful then if labourers so trained and superintended did not become most handy, skilful, and efficient workmen? I think every one will admit the truth of this, and will be fully inclined to believe me when I repeat that they are indeed most efficient and valuable labourers; that they thoroughly understand every branch of their work, and perform it in a highly intelligent and workmanlike manner.

I dwell thus fully on this point, because people are too much in the habit of fancying that slave labour, as it exists in the southern states, is merely that of a set of barbarians, urged on by the whip; labour which can be excelled by white men in the proportion of one of the latter to three of the former. There cannot be a greater error—a more absurd mistake.

If such negroes could be had in our colonies, and would work as they do on the cotton plantation, I would rather have them at Englishmen's wages than any white men I ever saw; and I even doubt whether they would not be worth double the value of a white labourer.

We may, therefore, truly say that the American cotton planter has cheap labour, because it is really so well-trained and so good; so incomparably superior to mere brute strength bunglingly and wastefully applied

I have passed a portion of my life in India, where we have another description of cheap labour, viz., full-grown and able-bodied men at six shillings a month, finding themselves in food and clothing; but how many of these coolies can we estimate as being equal to one trained negro?—The disparity is really enormous, if we quit hand-labour, and come to horse or mule-husbandry, which every agriculturist knows, constitutes the very life and soul of plantation work. It is true that these coolies can be taught—in time, and by dint of personal exertion and perseverance of the most wearying nature, as I well know, having had some thousand of them daily on whom to exercise my own patient determination, and from whom to learn the length, and breadth, and depth of a native's passive resistance to practices opposed to his own prejudices. I reiterate, therefore, this important truth, that the planter of the southern States has at his command such a body of trained labourers as we may seek for in vain elsewhere.

It behoves us, then, to bear this fact in mind, with a view to discover how we can apply our inferior labour, backed by our own energies, in competing successfully with them in the cultivation and supply of both descriptions of cotton.

Let us not shut our eyes to any of our difficulties and disadvantages, but manfully look them all in the face, and apply ourselves to the discovery of means whereby we may satisfactorily overcome them.

The description of labourers which we, as Englishmen, have to deal with, depends of course upon the locality in which we decide to carry out our operations. I will therefore refer to their several merits and demerits as we glance at the suitability of the countries themselves.

Cotton Growing Localities of Britain.

I must ask attention in the first place to the particular climate and seasons demanded by the cotton plant, and to some very marked features in its character.

In the early part of their growth, if the young plants have a few slight showers of rain until they have taken good hold of the ground and become about a foot high, it is surprising how much dry weather they will afterwards stand. Last year, in South Carolina, for seven weeks there did not fall one drop of rain; then they had a few light showers, followed by another spell of dry weather; yet it was considered a good cotton season, the bushes thriving well, and producing abundantly, notwithstanding that the intense heat of the sun had baked the soil as hard as a brick.

In remarking on this peculiarity of the plant, my planter friend replied, "Yes, for cotton we require very little rain indeed, whereas for corn, the more rain we have the more abundant are our crops, so that a very favourable season for the one, is sure to be unfavourable to the other."

In a wet season also, the planter has the greatest possible difficulty in making his cotton crop, for the weeds spring up so rapidly, and will not die, although hoed up repeatedly; whereas in a dry season, a light hoeing suffices to kill them and keep the fields clean.

This endurance of excessive dry weather is something quite remarkable; but I must also mention the hardiness of the plant in respect to cold, which in autumn does not seem to hurt it, unless a really killing frost occurs.

This hardihood gives to the cotton plant a very wide climatic range, although for commercial purposes this range is materially lessened, from the circumstance that it is essentially necessary to have comparately dry weather during the whole of the picking season; or, in other words, a dry autumn is imperative.

Last year (1857), the cotton plantations on the Mississippi suffered extremely from a dripping autumn; the bolls refusing to open, rotted on the branches, and those that did open fairly presented a forlorn appearance, with the cotton hanging down in long lengths, soaked and dripping with water.

The same reason it is which operates against Algeria, and which will prevent its ever becoming a large cotton-producing country, for the autumns and winter there are generally cold and wet, while the summers are generally parched and dry to a degree.

Of the three provinces, Oran appears to be by far the most suitable, although even there the plants require irrigation during the parching heats of summer. But if we go further westward, along the same coast, we shall find at Tangiers, as I am informed, a still more favourable climate and season.

But leaving the northern coasts of Africa, and also the more deadly West Coast (at present the scene of Mr. Clegg's enterprising labours), let us at once direct our attention to a right valuable British colony, enjoying one of the finest climates in the world, with cheap land, cheap provisions, and cheap labour. This is our hitherto neglected colony of Natal, in Kafirland, on the south-east coast of Africa. A three years' residence in that country has given me a sufficient experience of its climate, seasons, and capabilities, to enable me to speak with some certainty on these points, and I give it as my conviction, that in no quarter of the world can a spot be found combining so many advantages, and so peculiarly adapted to the growth of cotton, as our colony of Natal.

1. In the first place, the climate is most salubrious, and, for six months of the year, perfectly delightful, and highly exhilarating.

2. The rains occur during the six months of summer, whilst the other six months are dry, clear, and serene.

3. Suitable lands vary in price from 2s. to 20s. per acre, and being mostly all cleared, the plough can be put into them at once, at the smallest expense and trouble.

4. English farm-servants can be hired at much the same rates that are paid in England, and they in general become much more handy than they are in this country.

5. The natives (Kafir Zulus) may be hired at from 7s. to 10s. per month, besides their simple food, which costs only from £3 to £4 each per annum.

6. Excellent working oxen can be purchased in any number at from £2 10s. to £3 each. Mules, from £16 to £20, and horses and mares, at from £8 up to £20 each.

7. Beef, 2d. to 3d.; mutton, 4d.; pork, 4d. per lb.; fowls, 6d. each.

8. Pasture lands exist to any extent, and are of the most nutritious quality.

9. And lastly, the cotton plant is here perennial.

These facts and figures go to show the extraordinary advantages offered by Natal as a cotton-producing country, but we must not overlook the one great drawback, viz., the want of abundant and really reliable labour; for, at present, Kafir labour, though cheap, is not abundant, and cannot by any means be relied upon in so ticklish a culture as cotton.

This is indeed a very serious drawback; one that would effectually prevent any extensive cultivation of this plant, for when its bolls have opened and the cotton is ready for picking, it must be picked, or the crop will be lost. Fortunately, however, it is a drawback which admits of a remedy, and which the colonists are already taking seriously in hand, although I am afraid that unaided their means will not allow them to carry it out.

The Mauritius, which, after emancipation, was on the very brink of ruin, has not only been resuscitated by Indian labour, but has been raised to a far higher state of prosperity than it ever enjoyed before; and lands of any kind capable of growing the sugar cane have been bought up at £50 per acre. Why should the same remedy not be applied to Natal? Why should this fine colony not be supplied with any number of Coolies she may require, and thus become a great and valuable possession?

I know, along the coast line of 300 miles, abundance of land eminently suited to the growth of the finest Sea Island cotton; land that might be calculated on to yield from 200 lbs. to 500 lbs. of it, cleaned, per acre.

Immediately at the back of this line commences the region for the upland varieties; and what vast tracts are here lying idle, and, at present, next to useless; lands into which the plough may at once be put, and on which steam machinery may effectually aid the planter in all the branches of his work.

A few years ago, some German land jobbers and others got up a Cotton Company; imported a number of raw German families; built cotton houses, and erected machinery for ginning and pressing the bales; but, as in all such crude, ill-digested attempts, this Cotton Company turned out a dead failure, principally from two causes, viz., planting their seed in September instead of November, in consequence of which the cotton became fit to pick two months before the rainy season had ceased; and, secondly, the refusal of the German labourers to continue the cultivation, and their betaking themselves to other occupations.

The failure of this attempt has thrown discredit upon Natal as a cotton producing country; whereas, with a proper supply of labour, it cannot be excelled by any country in the wide world.

The next country to which I must allude is Australia, from the Illawarra district up to the Gulf of Carpentaria on the Eastern side, and the whole of Western Australia on the opposite coast; offering an extent of cotton country so vast that one hesitates almost to speak of it, seeing that at present nothing of the kind can be attempted for want of labour. Yet one cannot help thinking of the multitudes of lovely Sea Islands there are all along the coast, from Moreton Bay up to Cape York, all more or less suitable for Sea Island cotton, and all of which could be readily supplied with labour from India.

But let us pass on to India itself, that noble country, abounding in natural advantages, and possessed of a teeming population. The cotton region of Central India is said to be three or four times that of the Southern States of America, but hitherto its capabilities have not been brought into play, on account of the difficulty of bringing the produce to market from the far interior. Railroads are now, however, opening up this important region, and we may soon expect to feel the highly beneficial results of these wise and politic measures.

I have seen a great deal of cotton cultivation in India, and could dwell upon the subject at very considerable length; but I refrain from doing so, as I am well aware that the Society, at a subsequent meeting, will have a valuable paper on this subject, read by a scientific and highly competent gentleman.

I will therefore merely direct attention to two points, viz., the singular fact that no Europeans have ever attempted to grow cotton in India on their own account, but have contented themselves with buying the native grown cotton with all its imperfections.

Now, I am inclined to think that Europeans might make handsome fortunes by growing cotton in India; more especially, perhaps, were they to devote themselves to the finest Sea Island on the coasts, and down in the Straits of Malacca. With a suitable soil and climate, and labour at from 6s. in India to 12s. in the Straits, per month, I do not see why well organized cotton plantations should not pay well, and become general throughout the country.

The second point to which I would attract attention is, that if the United States employ upwards of seven million acres of land in the culture of cotton, and produce 3 millions of bales, we must bear in mind that India already cultivates double that quantity of cotton land, and produces almost entirely for internal consumption from four to five million bales—a fact little dreamed of in this country or elsewhere, but one which shows us how readily she could supply all the cotton we require, and much more, if the roads were opened and an energetic demand made upon her.

In carrying out the cultivation of cotton, do not let us overlook the assistance which steam machinery offers us; for it is by the aid of such machines as Romaine's, and others of a similar character, that I consider we shall be able to maintain in our colonies a successful competition with the trained labour of the southern states of America. Bear in mind that a really efficient machine of this sort would be equivalent to at least 10 slave "hands" and 10 mules; and knowing this, let us not fear such competition, formidable as it is.

In conclusion, I hope, and most earnestly trust, that our countrymen will, one and all, bestir themselves in this important matter, and never let the subject rest until we can positively assure ourselves that our great cotton manufacturing industry is placed upon a safe and unassailable basis.

DISCUSSION.

The Chairman said, considering this matter so very important to the district in which he resided, he hoped he might be excused if he deviated a little from the usual routine with which these meetings were conducted. Before, therefore, he called for the discussion upon the paper, he might be allowed to say a few words with regard to the vital importance of the subject. It had been said in these statistical days that there was nothing so little to be relied upon as facts except figures; but he would venture to give the meeting a few figures which he believed were as approximate to the truth as possible. Mr. Bazley had estimated that there was sunk in the cotton manufactures of this country, and the necessary buildings connected with it, a capital amounting to £50,000,000; that in the machinery establishments and other workshops that supplied the machinery for the same manufacture, there was £50,000,000 more invested, making in all £100,000,000 sunk in this trade. Mr. Bazley also estimated that there was no less than half a million of persons directly employed in the cotton mills, and that at least three more were dependent upon each of these workers, making two millions immediately dependent upon this manufacture, whilst there were two millions more engaged in the other trades which supplied the cotton manufacturers with their machinery. There were, therefore, upwards of four millions of our population dependent upon the working of this great branch of industry. There were no less than thirty millions of spindles at work in the cotton manufacturing districts. The imports of cotton for the present year it was expected would reach one thousand millions of pounds weight. The cotton exports in 1857 amounted to £39,000,000, while the home consumption of manufactured goods was £24,000,000, giving an average of 17s. per head for the whole population of Great Britain; and it was considered a moderate calculation that the whole population of the world consumed cotton manufactured goods to the extent of £140,000,000 sterling per annum, or equal to 3s. per head for the population of the world. He mentioned these figures to show the amount of property at stake, and the importance to the working classes at least, and to such men as himself, of the subject that had been brought before them. He would now show in a few words what this particular trade had done for Manchester, for Liverpool, and for Lancashire in general. In the year 1758, they imported only 2,000,000 or 3,000,000 lbs. of cotton, and he had already told them that in the current year it was almost certain to amount to a thousand millions of lbs. The population of Manchester, in 1758, was only 20,000. In 1858, it exceeded 500,000. The population of Lancashire, in 1758, amounted to 300,000, while that county now contained a population of 2,300,000; then, taking the tonnage of shipping at Liverpool, in 1758, it amounted to only 100,000 tons, whilst, in 1858, it had risen to 5,000,000. He had laid upon the table diagrams of the various cotton gins now in use, for the inspection of the members present, and he hoped that no one would leave the room without a full determination to help on this good cause to the utmost of his power. He had also arranged for the inspection of the meeting specimens of the various kinds of cotton cultivated, according to their relative value, beginning with the Sea Island, Egyptian and Brazilian, next the African, next the great staple of America, which kept them all going, and next the old-fashioned cotton that most of them were familiar with in their childhood—the Nankin cotton; and last of all the cotton of India, which was always found at the lower end of the scale of value. He had also laid upon the table a few maps of those districts of Africa in which he (the chairman) was most interested, together with some other papers connected with that country and its cotton-growing capabilities. He might add, in justice to his friend Dr. Riddell, whom he saw present, that although he had said that India unvariably stood in the lowest position as regarded the growth of cotton, yet Dr. Riddell had proved that India was capable of growing the finest Sea Island samples, and he had before him a specimen of Dr. Riddell's own growing, which was a proof, notwithstanding the assertion of the late Dr. Forbes Royle to the contrary—that the finest descriptions of cotton could be grown in India.

Dr. Riddell said—his name having been brought before the meeting, he rose thus early to say a few words upon the subject which had been so ably introduced to their notice. The question before them was that of the cultivation of cotton in America, and therefore he thought the subject of cotton cultivation in India had been rather prematurely introduced; but as his friend Dr. Forbes Watson would shortly read a paper upon the subject of the growth of cotton in that country, he (Dr. Riddell) would refrain from making any remarks upon the subject, further than to refer to what had been just said by the chairman. It was true that India was at the lower end of the scale as regarded the growth of cotton; but that was a question for the Indian government to deal with. Probably the "Pagoda tree" had been so well shaken that there was nothing left to pick off; but he was satisfied that the prospects of that country were opening bright before them, and if anything was calculated to bring the natives to a full understanding of their true position as regarded England, the proclamation of her Majesty which had just been issued would do more than the sword had ever done. He would add that he had paid a good deal of attention to the subject of cotton-growing in India, with the view of introducing a better description than the indigenous cotton. The gentleman who had favoured them with the paper that evening, had told them what other products might be obtained from the cotton plant. They had not only the cotton but the fibre itself, and they had also oil from the seed. With regard to the fibre, there was no doubt that from almost all tropical plants fibres might be obtained, but the question was whether they would repay the trouble in a commercial point of view. With regard to the oil from the cotton seed, they were told that 100 lbs. of seed produced two gallons of oil, equal, it was said, to the oil which they had from Lucca. But he believed that if half the oil sold under that name were subjected to the examination of the *Lancet* Analytical Commission, they would report that the greater proportion consisted of oils extracted from linseed and other seeds of that character. The green seed cotton undoubtedly produced a fine bland oil, but all the oil that he had seen produced from the black cotton seed of India was of a dark colour, such as that on the table. What its use was he could not say, further than that the natives of India burnt it in their lamps. They were told by Mr. Wray that the fine oil from the green seed was worth 6s. per gallon. Now, inasmuch as we could get oils from' various seeds at a much cheaper rate, he apprehended that it would be of little value in England, though in America, no doubt, it was valuable. He did not believe the natives of India extracted the oil of the cotton seed for any other purpose than burning, but they preferred to give the seed as food to the animals employed in ploughing and cultivating the land. He would now only thank Mr. Wray for the valuable paper which they had just heard.

Mr. P. L. Simmonds said that often as the subject of cotton had been brought before the Society, it had lost none of its interest—indeed that interest seemed to grow more and more year by year. The chairman had placed before them the immense money capital and industrial interests involved in the working up of this great staple, and had shown how large a number of the population were identified with a due supply of the raw material. It was, however, startling to think that there was not in our ports at the present moment cotton enough for a month's supply of our mills. The different phases of the cotton question had been brought successively before the members from time to time, but that evening they were brought directly to the consideration of its cultivation in the chief seat of supply—the United States. His friend Mr. Wray, whose acquaintance and correspondence he had enjoyed for a long series of years, was well fitted to deal with the subject in a practical point of view, from his great and varied experience as a planter in different parts of the world. He had resided in the West Indies, in British India, in the Straits settlements, and in Natal—and in all those localities he had been eminently useful and singularly energetic. It was but recently that he had acquired a wide and deserved celebrity for introducing into the temperate regions of Europe and America an admirable variety of African sugar-cane, a species of *Holcus*, calculated to be eminently useful both as a sugar yielding and a fodder plant; and while introducing this in America he had not lost sight of the interests of his countrymen, but had studied carefully the whole process of cotton culture as practised in the States, and of which comparatively little was generally known. Leaving to others the discussion of various topics arising out of the very interesting paper just read, he (Mr. Simmonds) would confine his observations chiefly to the consideration of those auxiliary products of the cotton plant, (other than the wool), which had been incidentally noticed by Mr. Wray, and which it had been too much the custom to overlook in treating of cotton cultivation. They formed in the aggregate a very important item in the returns, and if properly developed might become great commercial products. There was no doubt, from the chemical researches of Dr. Jackson, of Boston, Professor Shepherd, of South Carolina, Professor Anderson, of Edinburgh, and others, that cotton seed might be profitably employed in the production of a rich oil; that the woolly fibre adhering to the hulls might be economised in the manufacture of paper, while the substance of the seeds could be employed more generally for feeding animals, and also as an excellent fertilizer. It was extensively used in the Southern States as a manure for Indian corn, for which it was found most useful. There could not be less in all the cotton-growing countries than 1½ million tons of seed available annually for agricultural and commercial purposes. Two years ago he had called the special attention of our agriculturists to the subject of cotton seed in the *Farmers' Magazine* and the *Mark Lane Express*, in some suggestions of new sources for obtaining oil cake for feeding purposes and for manure, in these words:—"Another equally extensive field of supply, scarcely touched, is cotton seed cake." And after going into the statistics of the cotton production in Asia and America for a series of years, he added:—"Each pound of ginned cotton produced yields about three pounds of seed, and after reserving one half the seed for planting, the remaining cotton seed of the United States might be made to yield at least 400,000 tons of oil cake, the produce being about 50 per cent." This cotton seed cake was now exported largely from the United States to the Mediterranean, and it was imported to a small extent into this country from several American ports, in round cakes from Ohio, from Boston, Albany, and other quarters, and the finest American cake was imported in barrels. Analysis showed that these cakes were characterised by the presence of a larger proportion of oil than was usually met with in those of European manufacture, and the quantity generally was good. The oil varied in them from 9 to 16¼ per cent., and the albuminous compounds fluctuated between 26 and 31 per cent. The oil, stearine and oleine, made the best kind of soap for woollen and other goods, and either the hard or soft soap from it was found to be excellent for fixing Turkey red and other difficult colours. Cotton seed cake held a very respectable place compared with other oil cakes as an article of food for cattle, containing about 9 per cent. of oil and 25 per cent. of albuminous compounds, the two most important constituents in any feeding stuff. It could be used profitably as a substitute for linseed cake if the price were not too high. The number of seeds found in one capsule varied in different species of cotton from 5 to 12. Mr. Wray had told them that the short staple cotton yielded two to three pounds of seed to each pound of ginned cotton, and the Sea Island about 4 lbs. As yet, only the smooth black seed, he believed, had been used for the purpose of manufacturing oil, the downy seed resisting the action of the machinery, but machines could, doubtless, be invented to overcome the difficulties encountered with the woolly seed. In some varieties of cotton the seeds were free, oblong, black, and without any other pubescence than the long, fine, easily separable, white wool; in others the seeds were free, clothed with finely adhering greyish down, under the short staple white wool; while in a third kind the seeds adhered firmly to each other, so as to form a clustered mass resembling a kidney, black, and free from every pubescence except the long white wool, which was easily removed. He had placed upon the table for the inspection of the members, these several varieties of seed from his private collection, and the ordinary dark cotton seed oil met with in this country. The manufacture of oil from cotton seed had been carried on in the south for a greater or less extent for several years past. At Natchez one of these mills had been in operation for ten years or more, but so far the oil had not come into general use. The difficulty seemed to be in clarifying it, as it would not burn in a crude state. If this could be done successfully, it would prove a most important article of commerce. A recent writer in a Cincinnati paper, assuming that cotton seed yielded 30 per cent. of oil (although 40 and upwards had been obtained by good pressure), stated that the total product of oil that could be obtained from the seed raised in the United States would be 84,000,000 gallons, the residue being oil-cake, amounting to 700,000 tons. Although, from the samples he had seen, he doubted its applicability as a salad oil, it burned with great brilliancy, and was particularly fitted for using upon heavy machinery, on account of its not running or drying; it might also be useful for leather dressing. In many parts of India cotton seed was a distinct and important article of commerce, and, as Dr. Riddell had stated, in great request for feeding cattle. It was usually taken on board home-bound ships with grain for feeding milch cows. The supply of cotton seed was almost inexhaustible, as the sources were unlimited in the cotton-producing countries. In this country cattle did not take readily to the cake at first, but eventually they got to like it, and throve upon it. Opinions differed as to its fattening properties for sheep compared with linseed cake, but the much lower price at which it could be sold (nearly one-half), was certainly a very material consideration. The value of the fibre he was not prepared to enter upon, and this required further experiment. But the money value of the oil and oil-cake alone was shown by Mr. Wray to be considerable, and therefore well worthy of attention where cotton was grown on a large scale. He would be glad to hear Mr. Wilson's opinion of the commercial value and character of cotton seed oil.

Mr. G. F. WILSON, F.R.S., said that as his name had been mentioned, he ought perhaps to say a few words respecting the oil and grease from cotton seed. The quantity the author of the paper gave, as capable of being produced annually in America, amounted roughly to 200,000 tons, or more than four times the quantity of all the palm oil which came to this country. Its magnitude therefore rendered it well worthy of consideration. Cotton seed, principally, he believed, from Egypt, had been crushed in this country in considerable quantity, and the seed had been even freed from its surrounding fibre by means of machinery. While he agreed with Dr. Riddell's remark that India was too rich in seeds containing oil,—at least as valuable as that of the cotton seed, cheaper and easier of extraction, from being more lightly held in their matrix,—to make it probable that the cotton seed would be worked there on any very large scale, yet he might mention that oil, as dark coloured as the specimen shown, was, when newly extracted, easily refined, and then became of about the colour and appearance, and, he believed, of nearly the value, of mustard seed oil, or of the coarser description of rape seed oil.

Mr. FREDERICK LAWRENCE said he was one of the class referred to in the paper who could not distinguish between one quality of cotton and another; but there was one question which had nothing to do with quality—that was the labour question; and he thought they had learnt that evening something very startling, namely that the real cause of the prosperity of the American cotton growers was the whip. They learnt from the paper that the way to make a good labourer was, when he was a child, to show him the whip; when he got a little older, to make him feel the whip; in fact, to bring him up under the whip; and then it was agreed that he must be a good hand because he had everything to make him a good labourer and nothing to make him a bad one. He could not quite agree with that doctrine, nor did he admit the comparison made by Mr. Wray, of negro labour with other labour. It was asserted that the coolies could not work so well as the negroes, and that an Englishman could not do so much work in cotton cultivation as the slave labourer. No doubt the climate would have much to do with this, but Mr. Wray had not told them how he thought free labour would answer in the United States. He (Mr. Lawrence) could have wished they had been told how, in the opinion of Mr. Wray, the laying out of ten shillings per week—which it seemed was about the cost of a slave—in the wages of a free labourer would answer in cotton cultivation. That was a question which he thought would be interesting to all present.

MR. JONES mentioned that he had been informed by an American cotton-planter that the annual value of the labour of a slave was £80, and it had been stated by the American Consul that the value of the slaves in the United States was no less than £800,000,000, or equal to our national debt.

Mr. HYDE CLARKE said that one especial value of Mr. Wray's paper was the marked distinction drawn between the varieties of cotton, a subject of great importance, more particularly at this moment, when so much discussion was going on as to the application of irrigation in India to the long and short staples of cotton, and as to which so much diversity of opinion prevailed, particularly as to the irrigation of cotton districts. The application of the cotton products was another interesting point. The explanation of the failure of the cotton experiments in Natal was likewise very desirable at that moment, because great discredit had fallen on cotton cultivation in that colony. The present moment was one of great promise for cotton in that district, for if the Natal colonists succeeded in the application of coolie labour to the sugar crop, they would be encouraged to resume the cotton cultivation, and there was no reason why they should not be able to do for Natal what the Mauritius had done for sugar and Ceylon for coffee, by obtaining coolies from the abundant labour market of India. Mr. Wray's paper was of the greater importance because the United States afforded not only materials for the history of the past, but an example for our guidance in future operations. For instance, if we were really to do anything in India, it must be by profiting by the experience of the States, by watching what had been there done, ascertaining the principles in operations, and applying those principles. He thought that the enterprise and energy of the Anglo-Saxon race had been the main instrument of progress. The broad fact remained, that, in spite of all difficulties, the resources of India had continually advanced, and this progress could be ensured, and its speed increased by the further application of the same agency as in the United States, viz., the enterprise and intelligence of an Anglo-Saxon population. In this point of view the formation of English colonies in those parts of the healthy hill regions near the cotton districts was of great importance. The organisation of labour was another element, and this was dependent on the application of intelligence in its direction. The population of negroes would never of themselves have created the cotton trade of the United States, nor had the population of India been able to supply the demands of commerce. The land question was a most important element in the comparison. In the United States land was free and cheap, and fresh land could be acquired for the cotton cultivation, but in India no freehold could be acquired, and the holders of lands held on grant terms were at the mercy of the revenue authorities and their corrupt dependents. Good communication by water and by land for the transport of produce had been established in the United States by the efforts of the government and individual citizens, but in India it had yet to be established. The water and railway communication created in the valley of the Mississippi within the last quarter of a century exceeded all our efforts in India. He had that day received a letter from India, stating that in the Darjeeling district of India—one very interesting for the growth of Sea-island cotton—a branch had been formed of the English Settlement Association, and that one point to which attention would be particularly directed would be the development of the cotton cultivation.

Mr. Winkworth said that, complete in all respects as the paper now under discussion would seem to be, there was a country now fully opened to us, in which the question of labour could not be difficult—he meant China—of which alone Mr. Wray had said nothing. His experience of the recent history of an analogous raw material, as regarded relative demand and supply—viz., silk—afforded encouragement to believe that a similar amount of attention to the cultivation of cotton in that country would produce the most important benefits. He wished, therefore, to ask Mr. Wray whether China did afford elements of encouragement to expect sooner or later a supply of cotton for our manufacturing wants.

Mr. Wray would reply to the several questions raised in the course of the discussion, by commencing with the subject of oils. The specimens upon the table were by no means of the description to which he alluded. They were quite a different product. These were the crude productions of unskilful hands. What he had spoken of was the oil made in large manufactories in America by skilful men, practised in the art. He had said nothing at random on that point, for it was the fact that oil was made in large manufactories, both in the north and in the south, from American cotton seed; and that oil, as he had stated, was selling in New Orleans at four shillings per gallon, and fetched six shillings per gallon in New York. Those prices had no reference whatever to the cost of production, which might be only a few cents per gallon. It should, however, be understood that the oil was almost entirely made from the green Upland seed. It was necessary that the seed should undergo the process of hulling, or removing the husk which enveloped the inner portion of it, from which the greatest amount of oil was obtained. This hulling machinery had been brought to great perfection in the United States, and was the subject of numerous patents. The oil he had alluded to was of a very fine quality, and was certainly sold at the prices he had mentioned. The next point was that of irrigation. He thought that, next to railways, he looked for the greatest benefits to accrue from a proper system of irrigation in India. To understand that question properly, they must be acquainted with the nature of the climate and seasons of India, and a residence of many years in that country enabled him to speak with tolerable accuracy upon that subject. The rainy season commenced generally about the middle of the month of June, and lasted till about the 21st September. For the cotton plant that was too short a time. The consequence was that it was usual to plant the cotton before the rainy season came on. In the upper parts of the country that was the time when the hot winds prevailed, which he could only compare to the blast of a furnace. The earth became parched, and the seed at that period stood in need of irrigation, otherwise it would not germinate, but if sown with irrigation, and followed up by one or two subsequent irrigations, the plants became well-rooted, and would perhaps be a foot or 15 inches high when the rains set in. The growth then began with amazing rapidity, and by the time the rains ceased there was a fine plant. Then they had the scething month of October, and this was, perhaps, the most oppressive month of all in India, but it suited the cotton, which began to open its bolls in the latter part of October; then followed the fine month of November, which was succeeded by the cold months of December, January, and February. But at this latter period they had another change of climate. From September, when the rain ceased, there was sufficient moisture in the ground to maintain the plant in a vigorous state for a considerable time, but about December it began to flag again. In some years there were no showers during the whole of the cold season; and the entire crops in the upper districts required irrigation. Thus, therefore, the plant had to undergo three different seasons, first the dry season, during which it must be sustained by irrigation; then the next three months of rain, which was sometimes very trying to the plant, and subsequently there was the second recurrence of dry weather, when they looked for the cotton to be produced, and when irrigation again came to the planter's aid. Whatever they might say of cheap labour in India—and he had had as many as 1,500 men daily at work on his estate,—whatever they might say with regard to Indian labour as applied to irrigation, it was expensive compared with the irrigation which Europeans could effect by means of machinery. When they came to the cost per acre, they could judge whether it was cheap or not. The system of irrigation which the natives of India still pursued had been in use amongst them from time immemorial, and at present there was no such thing in the cotton districts of India as irrigation by means of machinery. The time at which irrigation could be successfully pursued was the ripening season, and irrigation at that period furnished the plant with the very thing it wanted, and they could irrigate and pick the cotton at the same time. The next point was with regard to the quality of the cotton of India. He might say the operation of irrigation properly carried out would bring into cultivation immense districts of country near the the coast, which had never yet been brought into cultivation. On the coasts—take, for instance, the Sunderbunds, near Calcutta, a vast tract which, although unhealthy to European constitutions, was well adapted to the long staple cotton,—the soil contained a certain quantity of saline matter, in which the cotton plant was found to thrive, indeed, it was in a similar description of soil that such large crops were grown on the Sea Islands, South Carolina, and he believed there were districts in India which were capable of producing as good cotton as South Carolina. The next question was with reference to China. The climate of China, he did not consider himself competent to speak of. He did not know whether the autumns and winters were wet or dry, but he believed they were wet. They must, however, remember that China had the enormous population of 500,000,000 of inhabitants, and they were obliged to cultivate every scrap of land, and to get two or three crops a year in order to support so vast a population. It was not a cotton producing country—it could not even supply its own wants. A large quantity, indeed the great bulk of Indian cotton exported, was sent to the Chinese markets. He looked to our Indian possessions to supply a much larger amount of that commodity to China, now that that country was more fully opened up to our commerce. He had had as many as three hundred Chinese labourers in his own employment, and, if properly managed, a finer body of men did not exist; they were docile, hard-working, and sober, and did their work well. The last subject was that of slave labour. He had endeavoured to say as little as possible upon that point. He had stated in the outset of his paper that he would keep to facts and figures, and that he would treat the subject strictly in a business point of view. As business men, they had nothing to do with the question of slavery. He had directed attention to the fact that there was a certain class of highly trained labour in America, and it was not a point for their present consideration how it was obtained. He had seen the labourers of many countries, and he could state it as a certain fact that in America they had labour of the most skilled description for the culture of cotton, and that fact they must not ignore. He never knew the pitch of perfection to which negro labour could be brought until he witnessed it on the property of Gen. Hammond, ex-Governor of South Carolina. He repeated that they had inferior labour in India to that of America. As Englishmen they were never going to resort to the whip, and therefore they must endeavour to discover some other means of competing with that highly-trained labour. Our countrymen had great perseverance and energy, and we had in our own colonies an extent of land, beyond anything he could mention, suitable for the cultivation of cotton, and wherever there was scarcity of labour, it could be imported. But there was another point which he thought was important, namely, the introduction of steam machinery. He was one of those who saw plainly that they must use steam machinery in the cultivation of the land, and it would, in fact, be far superior to slave labour—for it was a slave that never tired, that wanted no whip, and of which our countrymen would never be ashamed.

The **Chairman** felt personally obliged to the meeting for the great attention which had been given to this subject. As the question of slavery had naturally been touched upon, he could not but take the opportunity of expressing his great abhorrence of the system, and, moreover, in his opinion, it was quite possible to get as much cotton as they wanted—abundant and cheap—without any slavery at all. Some ten years ago, seeing the importance of the subject, he thought he would, as an individual, see if he could not get cotton from somewhere else than from America. He turned his attention to Africa, and he asked the Church Missionary Society, of which he was a member, to select for him suitable agents, to whom he could entrust money for the purchase of cotton from the African natives. He made arrangements always to have money on the spot, in the hands of the agents, and his instructions were, that they should purchase the cotton of the natives, in however small parcels it might be brought to them—if only half-a-pound had been plucked from the wild plants, they were to buy it. The consequence was, that in a short time the women brought small quantities of cotton to the stations; this was communicated to their neighbours, and, in a little time afterwards, seed was planted, and the cotton bushes became more and more plentiful. He sent out a number of cotton gins, and the natives soon learned to use them. He also erected a store, and placed a large number of gins in it. The natives brought the cotton in pods and in seed, and they learned to clean it, and after using a gin sufficiently long to pay the expense of it, they shouldered the implement, and carried it off as their own property, to be used hereafter in dressing the cotton they brought for sale. He had introduced three young African natives into his mill, at Manchester, where they had been taught the use of machinery generally, and they were sent back to their own country, to carry out the preparation of cotton upon a larger scale. He had received cotton from Africa in the following quantities:—In the first year, he was able to collect only 235 lbs.; the next year, it was 1,810 lbs.; in the third year, it was 4,617 lbs.; in the fourth year, 1,588 lbs.; in the fifth, 1,651 lbs.; but whilst he was receiving these small quantities, he was teaching the young men in his mill. After they got back to their own country, there was an increase in the quantity of cotton to 11,492 lbs. in the next year; in 1857, the quantity was 35,419 lbs., and there was lost by fire, in addition, 38,080 lbs.; and this year he had already received and sold 1,207 bales, and since his arrival in London he had received bills of lading of 612 bales in one vessel at one time, so that, up to the present moment, single-handed, he would have received, up to the end of October, no less than 1,819 bales of African cotton. If one individual could effect this, what might they not hope would be the result of the united operations of a number of persons in promoting such measures as those, wherever it was found that cotton would grow. He had not been contented with the West Coast of Africa alone, although it was proved that cotton would grow abundantly there. At Tunis, he, with other persons, had commenced a cotton-growing company, and 1,500 acres of land were under cotton cultivation there. The association, however, commenced their operations so late in the season, that they could not get a good crop, but it had been demonstrated that good cotton could be grown in Tunis by free labour. He had recently received a letter from the Bishop of Natal, in which he stated that the impression in that colony was, that the cotton crop would only yield £1 3s. 4d. per acre; but, from statistics which he (the Chairman) had seen, it was proved that the land, under cotton cultivation, would yield a return of £12 10s. per acre, whilst by growing maize they only got a return of 40s. or 50s. A gentleman, residing at Natal, had expressed his willingness to devote an estate of 8,000 acres to the cultivation of cotton, and to find the money to work it. He (the Chairman) had also received a helping hand from Dr. Livingstone, at whose disposal he had lately placed £500 for the purchase of cotton, and for otherwise forwarding the object he had so much at heart. He was also commencing two new stations on the West Coast of Africa, where he had eight presses at work, capable of turning out 80 bales per day each; and he was about sending out five others, of larger size, which would be able to turn out 130 bales per day. He would say, in conclusion, that he felt heartily obliged to Mr. Wray for his paper, and it was a source of great satisfaction to him to find so many persons taking an interest in this subject. As regarded the interests of Manchester, it was a question of life and death; therefore, he called upon all present to give their aid in this important movement. The Chairman then proposed a vote of thanks to Mr. Wray, for his able and useful paper.

A vote of thanks was then passed to Mr. Wray.

Mr. **Wray**, in acknowledging the compliment, begged to disclaim all personal sympathy with the system of slavery.

The Secretary announced that the next meeting of the Society would take place on the 19th of January next, when a paper would be read, in the French language, by Monsieur Théophile Silvestre, on "Les Arts, les Artistes, et l'Industrie en Angleterre depuis la dernière moitié du dix-huitième Siècle jusqu'à ce jour."

THE IRON TRADE OF FRANCE.

A correspondent of the *Times*, dating from Paris, December 20th, says:—

The *Moniteur* publishes the Customs returns for the month of November last, and for the past 11 months of the present year. These are the first which have yet appeared as showing the effect on French trade of the non-renewal of the October decrees, and therefore possess more than ordinary interest. It is not, perhaps, forgotten that the decrees I allude to admitted English and Belgian iron virtually free of duty, if re-exported in a manufactured state. The Prohibitionists maintained that the provisions of the decrees were not faithfully carried out, and that large quantities of foreign iron were not re-exported, but were introduced into the general trade of the country. They required that all consumers should be compelled to come to their shop by imposing an all but prohibitory duty upon raw iron, no matter to what purpose it might be applied, and that they would undertake to amply supply all their wants, pay higher wages to their workmen, employ more hands, and consequently contribute to the greater prosperity of the State. They further declared that, if foreign iron were not admitted, under guarantee for re-exportation, the importation would be reduced, as it would be impossible to admit it in the general commerce of the country. Now, it was a serious charge for the Protectionists to make against an important and respectable section of the community, that they evaded the fiscal laws of the country, defrauded the Treasury, and were, in fact, no better than vulgar smugglers. It was, however, made so openly and so boldly that people believed it; and it is only now, with the evidence of the Customs' returns before them, that they see how utterly unfounded was the charge, and how regardless of truth were those who made it.

The total quantity of pig iron imported last month was 9,298 tons against 10,292 in November, 1857, and against 11,179 tons in the corresponding month of the preceding year. The regularity of the decrease in each month of the three years proves that the importations have been but slightly affected by Customs' regulations, as it does the falseness of the allegation about the fraudulent introduction of foreign iron. It is the same with bar iron, of which 1,684 tons were exported last month, against 4,416 in the corresponding month of last year, and against 6,276 tons in November, 1856. Here, again, the progressive decrease shows that the cause must be looked for in the decline of trade. What proves this to be the fact is, that the importations of other metals against which French manufacturers are not protected have fallen off in much greater proportion. Thus, on comparing the importations of last month with the corresponding month of last year, it will be found that those of copper fell from 1,472 tons to 1,210 tons, of lead from 2,285 to 1,196 tons, and of zinc from 2,782 to 1,262 tons.

These figures show that no iron was fraudulently introduced, and that the decree authorizing its admission in bond to be manufactured into goods for re-exportation was positively beneficial to French trade; also that, however high protective duties may be carried, there will always be a certain quantity of foreign iron admitted by the laws of demand, because the French ironmasters, in their grasping after large profits, will always keep up their prices to a level with the cost of foreign iron in France. Any reduction in importation will therefore follow from a falling off in the general consumption. It is the national consumer who will suffer, by being compelled to pay exorbitant prices for the material he absolutely requires, and to reduce his wants to those narrow limits when he will be forced to use charred wood for ploughshares and oyster-shells for razors! The loss to foreign traders will be comparatively slight, and will be more than compensated by the gradual expulsion of French goods from foreign markets, in which it will be impossible for the latter to compete when the cost of production is rendered so extravagantly high by the artificial value of so necessary and extensively employed a material as iron.

Colonial Correspondence.

THE MANATI.

Sir,—In Goldsmith's "History of the Earth and Animated Nature" I find a description of the manati,—so called from the Latin word *manus*, because the fin or paw of that animal bears some resemblance to a human hand. That description is partly correct, and partly incorrect. It is as follows:—

"The eyes are very small in proportion to the animal's head, and the ear-holes—for it has no external ears—are so narrow as scarcely to admit a pin's head. The tongue is so short that some have pretended that it has none at all; and the teeth are composed only of two solid white bones, running the whole length of the jaws, and formed merely for chewing, and *not tearing its vegetable food.*"

I will not dwell upon the absurdity of an animal *tearing vegetable* food.

I have lately obtained possession of the head of one of these extraordinary animals, and I am therefore in a position to give a correct description of it.

It is quite true that there is no external appearance of any ears, and that the tongue is much shorter than that of a cow; but it is a great deal thicker. The eyes are comparatively small, but they *appear* to be much smaller than they really are, in consequence of their being overlopped by a thick lid. The description of the teeth contained in the above extract is quite wrong. I have now the skull before me, and a very singular one it is. The animal possesses no incisors, it is true, neither has it any canine teeth,—the latter being totally unnecessary, as it feeds entirely upon the marine herbage, which grows in great abundance at the mouths of the rivers in this country. But in the upper jaw there are no less than twelve large molar teeth, and in the lower jaw there are fourteen. Goldsmith says, "It is very probable that this animal's flesh somewhat resembles that of turtle, since they are fed in the same element, and upon the very same food." This is very inconclusive. We might just as reasonably say that the flesh of sheep must resemble that of cows, as those animals feed in the same element, and upon the very same food; and for the same reason turkey must resemble goose, and turbot, salmon. The fact is, the flesh of the manati is as unlike that of the turtle, as it is possible for one kind of flesh to be unlike another. The flesh of the turtle is tender and fibrous, that of the manati is short and hard. Even the fat more resembles cartilage than that pinguinous substance.

The author of the book before referred to also says:—

"The turtle is a delicacy well known among us; our luxuries are not as yet sufficiently heightened to introduce the manati, which, if it could be brought over, might singly suffice for a whole corporation."

There is a vast difference between these two animals. The turtle, when fresh and in good condition, is the most delicious, and at the same time the most digestible of food. The flesh, which is white and delicate, is covered with a thick stratum of green fat, and the fins are glutinous. The bone which covers the breast, is intermingled with a thick cartilage, which, when boiled down, becomes perfectly tender, and is often in England mistaken for green fat. The manati possesses no such claims to the regard of corporations, either aggregate or sole. I do not think that there is an alderman in any corporate town of England (I won't bargain for Scotland, for those who can eat singed sheep's *heed*, and call it luxury, would perhaps rejoice in it) who would not turn up his municipal nose at it; and there is no round, plethoric vicar who would not infinitely prefer his turkey and chine, or the savoury crackling of his tithe pig, to all the manatis in the world. I am, &c.,

R. TEMPLE.

Belize, B. Honduras, November 17th, 1858.

Home Correspondence.

MR. REED'S PAPER ON THE SHIPS OF THE ROYAL NAVY.

Sir,—Upon the interesting and instructive paper read by Mr. Reed on Wednesday last, I beg to offer a remark.

It is apparent that in the application of steam-power to nautical purposes, a change in navigation has been induced, which will now render supremacy upon the ocean more dependent upon the high speed of war vessels than upon magnitude and capability of carrying heavy ordnance. Admitting such to be the fact, I am of opinion that comparatively small, but fast and properly constructed steamers, armed with submarine explosive shells, which can be towed, or otherwise brought by such vessels into hugging contact with vessels of inferior speed, or monster ships armed with cannon, will prove more than a match for them under hostile conditions.

It is only by experiment, or by actual combat, that such a problem can be solved; but I would most humbly suggest the propriety of its solution experimentally, ere more labour and skill be expended upon vessels that may prove useless, and upon which we may chiefly depend as a means of defence. I am, &c.,

J. HARVEY, Capt. R.N.

Harnden, Sandwich, Dec. 20, 1858.

Sir,—In the report of the discussion after Mr. Reed had read his highly instructive paper at the Society of Arts, on the evening of Wednesday last, I am made to say that it was with the *present* military rifle that I pierced an iron plate of three-eighths of an inch thick at sixty yards. What I did say was that, with the two-groove military rifle, using an elongated rifled *iron* shot, I pierced a plate of the toughest *Russian* iron three-eighths of an inch thick, at the distance of sixty yards, more than six years ago at Cork, during the time of the national exhibition there. I beg you will be pleased to have this letter inserted in the next number of the *Society of Arts Journal*, as the two-groove rifle was a *strong* one of 14 to the bore, and the iron or steel shot was three diameters of the bore in length, and had two elliptic tetons or nipples of lead at its base, to fit into the two grooves of the rifle, whereas the present service rifle is only 24 bore, and I should not like to make a similar experiment with it, not considering it to be sufficiently strong to bear such a trial. I am &c.,

J. NORTON.

Rosherville, 20th Dec.

Sir,—The following is the description of the American Steam Ram and Battery, which I received before reading my paper at your Society's last meeting, and to which I made incidental reference on that occasion. It was obtained, as I then said, by a stratagem, and is valuable as the record of an eye-witness. I am, &c.,

E. J. REED.

"Mechanics' Magazine" Office,
166, Fleet-street, London, 20th Dec. 1858.

"Stevens' Steam Battery is an iron vessel, now building for harbour defence *only*, under a contract with the late Robt. L. Stevens. It is about 440 feet in length and 50 in breadth, and is built apparently for speed, being very sharp forward, with clean run, greatest breadth abaft the centre of length, and with flat floor. She is now built up only to about the light load line. the 'planking' being $\frac{1}{2}$-inch boiler plate double riveted to U-shaped angle iron 'timbers' about twenty inches apart; no 'ceilings' as yet; 'deck-beams' of U-shaped angle iron are in for two rather low decks, and the hold has on each side a large iron tank, extending some 200 feet amidships, and leaving but about twenty feet of space between the two tanks on the line of the keel. Each tank appears to be independent of the other, and at the forward end has an inclined engine, very heavily proportioned, which seems to be arranged for condensing air into the tank. Over the top of the tanks are large pipes of boiler plate, connecting the engine with the tank at several places, as if the tank were composed of subdivisions. No propelling apparatus is yet apparent. The plan, *as report says*, is to carry a heavy battery, of long range, as near to the water as possible, using the air tanks to secure safety from sinking if pierced by a shot below water, or from water which would wash into the low ports. The battery to be covered by a sloping roof so that shot would glance off, and the vessel to have speed enough to be able to keep at long range. The original appropriation by Congress was 500,000 dollars 'toward' the construction. The executors have claimed that a little over 800,000 dollars has been expended, and that about as much more will be required to complete the vessel, though whether this is to include equipment and armament is not definitely stated. There has been much doubt expressed if the thing will ever be completed, although Mr. Stevens did contract for a specific sum, and of which he had received on account the appropriation of half-a-million dollars, as above. At present, there is only enough work doing to justify the expression that 'the work is progressing.'"

MEETINGS FOR THE ENSUING WEEK.

Mon.......Actuaries, 7.
Tues. ...Royal Inst., 3. Prof. Faraday, "On Metalline Properties—Lustre, &c."
Wed. ...London Inst., 3. Mr. T. Rymer Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Thurs....Royal Inst., 3. Prof. Faraday, "On Metalline Properties—Chemical Power, &c."
Sat.......Royal Inst., 3. Prof. Faraday. "On Metalline Properties—Heat, Electricity, Tenacity, &c."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December* 17, 1858.]

Dated 1*st November*, 1858.

2428. F. Wrigley, Manchester—An improved self-acting safety coupling for railway and other purposes.

Dated 10*th November*, 1858.

2518. J. Corner, 15, Artillery-place, and 16, City-road, Finsbury-square—Imp. in machinery for making metallic screw rivets, and for uniting with them parts of boots, shoes, portmanteaus, leather hose, buckets, harness, and other leathern articles.

Dated 16*th November*, 1858.

2572. A. I. H. Parent, Paris—An improved manufacture of buttons and the apparatus employed therein.

Dated 17*th November*, 1858.

2586. E. Welch, 63, St. John's-square, Clerkenwell—Imp. in the manufacture of tobacco, and in apparatus therefor.

Dated 20*th November*, 1858.

2638. W. Lea, Wolverhampton—A method of lubricating cocks and taps.

Dated 26*th November*, 1858.

2684. J. Harrison, Blackburn—Imp. in rollers applicable to sizing dressing, calendering, and squeezing machines.
2686. A. Bowie, Glasgow—Imp. in governors for marine engines.
2688. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved manufacture of leather. (A com.)
2690. T. B. Hubbell and G. J. Rollason, Castle-street—Improved apparatus for brightening and polishing metal surfaces.
2692. W. Richards, Harpur-street, Red Lion-square—Imp. in the construction of gas meters.

Dated 27*th November*, 1858.

2694. J. Spratt, 71, College-street, Camden-town—Imp. in the manufacture and strengthening of paper.
2698. R. Alexander, Dillichip, Dumbarton, N.B.—Imp. in treating, preparing, and bleaching textile fabrics and other materials.
2700. H. L. Pattinson, Stotes-hall, Jesmond, Newcastle-upon-Tyne—Imp. in utilizing the heat of slags of iron and other works.
2702. G. B. Sander, High Holborn—Imp. in jugs.
2074. S. Diggle, Radcliffe, Lancashire—Imp. in pattern chains, or other such apparatus used in weaving.

Dated 29*th November*, 1858.

2706. L. A. Possoz, Rue Neuve St. Augustin, No. 9, Paris—Manufacturing alkalies, and obtaining simultaneously other chemical products.
2710. G. Collier and W. Noble, Halifax—Imp. in means or apparatus for the manufacture of spokes for carriage wheels, which improvements are also applicable to the cutting of wood for other purposes.
2712. G. Hadfield, Carlisle—Imp. in the construction of carboys, barrels, and other vessels of capacity.
2714. C. Hancock, West-street, Smithfield—Certain imp. in the insulation and manufacture of electric telegraph wires and cables.
2716. W. A. Henry, Sheffield—Imp. in machinery or apparatus for attaching the soles and heels of boots and shoes to the upper leathers, and in the fastenings employed for that purpose.
2718. J. B. Blanjot, 8, Rue Thevenot, Paris—Improved petticoats for ladies.
2720. C. Bedells, Leicester—Imp. in the manufacture of elastic fabrics, and in the machinery employed in this manufacture.
2722. G. J. Bensen, 7, Christian-street, St. George's-in-the East—Imp. in cleansing or purifying animal charcoal after it has been employed by sugar refiners.

Dated 30th November, 1858.

2726. A. A. Burton, 30, Wych-street, Strand—A moveable face and handle for smoothing irons.

2728. D. Thomson, Old Brompton—Imp. in machinery for raising water and other liquids.

2730. A. E. C. Scheidel, Watling street—Imp. in fastenings for belts, braces, garters, books, portemonnaies, portfolios, pocket-books, invoice, writing, and cigar cases, reticules, bags, and other similar articles or purposes. (A com.)

2732. W. E. Newton, 66, Chancery lane—Imp. in telegraphing and in telegraphic apparatus. (A com.)

2734. J. Coulson, Newark—Imp. in threshing and dressing machines.

Dated 1st December, 1858.

2736. R. H. Bow, Edinburgh—Imp. in railway chairs and fastenings.

2738. E. Jones, Dudley—An imp. or imps. in the manufacture of coke in ovens.

2742. J. Samuel, Great George-street, Westminster, and J. Nicholson, Wellington-street, Bromley—Imp. in, and in connection with, marine and other steam engines.

2744. H. Adcock, City-road—Imp. in furnaces and apparatus for annealing wire.

2746. G. W. Bales, Ipswich—Imp. in apparatus for retaining doors, sashes, or frames, when shut or closed.

2748. S. Newington, Ticehurst, Sussex—Imp. in agricultural implements.

2750. F. Fincham, Ravenhead, Lancashire—Imp. in the construction of annealing kilns or ovens.

2752. J. Lewis, Elizabeth, U.S.—Imp. in means for attaching sails to the yards of ships or vessels.

Dated 2nd December, 1858.

2754. L. MacKirdy, Glebe Sugar House, Greenock—Improved combined bathing, washing, and water-closet apparatus.

2755. L. MacKirdy, Glebe Sugar House, Greenock—Imp. in the manufacture of sugar.

2756. J. Rogers, 9, Queen-square, Bartholomew-close—Imp. in the manufacture of ropes, cables, cords, and lines.

2757. W. Robertson and J. G. Orchar, Dundee—Imp. in machinery or apparatus for winding yarns or thread.

2758. J. Tyssen, Rotterdam, Holland—Imp. in obtaining and applying motive power.

2759. J. Baillie, Vienna, Austria—Imp. in the construction of railway wheels.

2760. Lieut.-Col. G. Spiller, R.A., 15, Upper Southwick-street—Imp. in knapsacks for military and other purposes.

Dated 3rd December, 1858.

2761. M. Henry, 84, Fleet street—Imp. in manufacturing or revivifying bone black or animal charcoal, and in kilns or apparatus employed therein. (A com.)

2763. M. Tooke, Norwich—Imp. in apparatus for measuring the human figure, and in applying the same for tracing out garments for the human figure.

2765. S. Peters, 12, Rue de la Briche, at St. Denis, near Paris—Imp. in the manufacture of pipes and tubes, and in the apparatus employed therein.

2767. C. Coates, Sunnyside, near Rawtenstall, Lancashire—Imp. in maundrills for printing.

2769. C. F. Vasserot, 45, Essex-street, Strand—Improved arrangements to be applied to window sashes to prevent draughts and the infiltration of water. (A com.)

Dated 4th December, 1858.

2771. J. Cameron, Glasgow—Imp. in apparatus for the manufacture of sugar.

2773. L. W. Fletcher, Bleaklow, near Bury, Lancashire—Imp. in the construction of electric telegraph cables.

2775. R. Pickering, Lockerbie, Dumfries—Imp. in communicating signals from one part of a railway train to another.

2777. T. Sibley, Ashton-under-Lyne—Imp. in looms for weaving.

2779. J. B. A. Monnier, Nemours (Seine et Marne), France—Imp. in actuating railway brakes.

2781. H. T. Yates, Hounds-gate, Nottingham—Imp. in the manufacture of boards or sheets when wood sawdust is used.

2783. M. Henry, 84, Fleet street—Imp. in weaving and in looms, or apparatus employed therein. (A com.)

2785. J. Platt, Oldham—Imp. in mules for spinning.

Dated 6th December, 1858.

2787. J. Jobson, Derwent Foundry, Derby—Imp. in the manufacture of stoves and fire-places.

2789. B. Nicoll, 40 and 42, Regent-street—Imp. in agricultural machinery for all kinds of crop, chaff, turnip, and other root-cutting, and for the purposes of haymaking, and rubbing corn and seed from the stalks (instead of threshing).

2791. G. Snell, Leeds—Imp. in machinery or apparatus for cutting woollen fabrics.

2793. D. B. White, Newcastle-upon-Tyne—Imp. in indicating gauges.

2795. F. W. Fletcher, Hurdington, near Birmingham—Imp. in bolts for securing doors, and other similar purposes.

Dated 7th December, 1858.

2797. J. E. Boyd, Hither Green, Lewisham—Imp. in the construction of taps, valves, cocks, spiggotts, or other apparatus or instruments for gauging or for drawing off the liquid or fluid contents of any cask, butt, vat, barrel, or other vessels.

2799. C. Williams and W. Ellison, 17, Acton-place, Kingsland-road—A new mode or method of securing and liberating the corks and stoppers of bottles.

2801. W. Madders and J. Waddington, Manchester—Imp. in machinery or apparatus for embroidering woven fabrics.

2803. G. E. Larned, Brooklyn, U.S.—Imp. in the construction and arrangement of the boilers and working parts of steam fire engines, part of which is applicable to engines for other purposes.

2805. J. Haslam and J. Lutener, Preston—Imp. in healds used in looms and dressing frames.

2807. S. W. Pugh, Nelson-square, Commercial-road, New Peckham—Imp. in obtaining and purifying naphtha, paraffine, and other oils, and also spirits.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Dec.* 17, 1858.]

December 17th.

1375. S. Taylor and D. Taylor.
1381. P. B. E. Martin.
1392. Sir J. C. Anderson.
1393. H. H. Henson.
1409. J. A. Rainé.
1474. J. Petrie, jun.
1490. T. Mellod, J. Duxbury, and E. Layfield.
1506. E. Simons.
1728. N. S. Dodge.
1731. W. Hartley.
1919. A. Rottmann.
1928. J. Dredge.
2116. G. M. Levi.
2185. W. Blake.
2313. J. Hick, W. Hargreaves, and R. Harwood.
2318. W. Clay.
2334. W. E. Newton.
2354. J. Baldwin, jun.
2358. J. H. Johnson.
2359. J. Burridge.

[*From Gazette, Dec.* 21, 1858.]

December 21st.

1395. R. A. Brooman.
1411. P. Brown and B. Young.
1415. T. Spencer.
1417. P. J. Livsey and F. L. Stott.
1418. W. Clibran and J. Clibran.
1424. J. Bates, J. York, and W. Parkin.
1426. G. Collier.
1436. J. Maudslay,
1441. W. L. Tizard.
1469. P. P. C. Barratt and J. B. Barrat.
1539. S. Harrison.
1581. R. Burns and J. Rea.
1703. W. E. Newton.
1815. W. E. Newton.
2017. H. J. Distin.
2068. W. H. Manning.
2273. W. Smith.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Dec.* 17, 1858.]

December 14th.

2861. C. Nickels and J. Hobson.

December 15th.

2844. G. Collier, J. Crossley, and J. W. Crossley.
2925. C. May and E. A. Cowper.
2927. E. A. Cowper.

[*From Gazette, Dec.* 21, 1857.]

December 16th.

2892. M. Tomlinson.
2895. E. Tyer.

December 17th.

2872. J. Hadden, H. Hadden, F. J. Hadden, and C. S. Hadden.
2875. G. Harvey.
166. P. A. le Comte de Fontainemoreau.

December 18th.

2866. E. Davies, J. M. Syers, and C. Humtrey.
2891. B. Hughes.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4132	Nov. 16.	Base and Tripod for supporting the Centre Pole of a Tent	B. Edgington	2, Duke-street, Southwark.
4133	,, 22.	Feed Roller for Chaff Cutter	Smith and Ashby	Stamford.
4134	,, 30.	Hall's Patent Cartridge Carrier	A. Perry	26, Ann-street, Birmingham.
4135	,, 30.	The Improved Alliance Buckle	W. Aston	Princip-street Works, Birmingham.
4136	,, 30.	Spectacle Side-piece Fastener	F. B. Anderson	56, High-street, Gravesend.
4137	Dec. 1.	Rein Holder	W. Hewitt	Birmingham.
4438	,, 7.	Cap or Cover for a Jar	A. Singer	Vauxhall Pottery, Vauxhall, Lambeth.
4139	,, 9.	Gentlemen's Wardrobe Hat case Portmanteau	E. Wilks	Hanover House, Cheltenham.
4140	,, 13.	The Standing Safety Fireguard	Panklibanon Furnishing Ironmongery Co. (limited)	56, Baker-street.
4141	,, 15.	Rack Pulley	S. Collins	Birmingham.
4142	,, 20.	A Block of Black Lead	G. A. B. Chick	Milk-street, Leek-lane, and Callow Hill street, Bristol.

Journal of the Society of Arts.

FRIDAY, DECEMBER 31, 1858.

NOTICE TO INSTITUTIONS.

The Committee of the Society for the Diffusion of Pure Literature have granted to the Council of the Society of Arts the privilege of giving recommendations to the Institutions in Union, enabling them to obtain at half-price libraries of £5 worth and upwards of books, to be selected from a catalogue issued by the Society, and which will be supplied to any Institution applying for it. The principal objects of the Society are to promote the circulation of such books, periodicals, prints, diagrams, and other publications as the Committee may, from time to time, deem really useful and good, whether they are issued by individuals or by Societies.

Institutions desiring to avail themselves of this privilege, should communicate with the Secretary of the Society of Arts.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following letter has been received from the Secretary of the Local Board at Louth:—

Mechanics' Institution, Louth, 24th Dec., 1858.

Dear Sir,—I am desired to acquaint you, for the information of the Council, that the Committee have appointed—

The Rev. J. T. Barker, the President of the Institution;
John Bogg, Esq., surgeon;
W. T. Kime, Esq., J.P., barrister-at-law; and
A. T. Rogers, Esq., The Priory;

the Local Board of Examiners for the ensuing year; and to state that, to induce a greater number of young men to enter the lists, they have determined to give a Prize of Thirty Shillings to every candidate from this Institution obtaining a First-class Certificate, and a Prize of Twenty Shillings to every candidate obtaining a Second-class Certificate. The Committee believe that this step will have its intended effect, but they are not in a position at present to say how many candidates they will have.

Yours truly,
B. CROW, Sec. to the Board.

P. Le Neve Foster, Esq.

SUBJECTS FOR PREMIUMS DURING THE SESSIONS 1858-59 AND 1859-60.

The Council, in issuing the subjoined List of desiderata, would urge upon the Members of the Society generally, and others, the importance of communicating detailed accounts of new processes in Arts or methods of Manufacture, of any modifications by which these may be simplified, or labour saved, and of any novel application of Raw Materials, whether previously known or not, to useful purposes. It is quite possible that some of the things here set down as to be done, may have been already accomplished; but in such cases the knowledge of them is limited. One of the objects of this Society is to elicit discussion on the subjects with which it deals, to see that nothing is concealed which may in any way tend to promote the good of all, and to record facts and opinions. The weekly meetings, and the *Journal of the Society of Arts*, afford the requisite facilities for effecting this, and the Council earnestly hope that the opportunities thus given may be taken advantage of.

Patented Inventions are not excluded from receiving the Society's rewards.

The Society is willing to receive communications on subjects not included in the following list, but in all cases expressly reserves the power of rewarding any communication according to its merit, or of withholding the Premium altogether.

The degree of originality and extent of suggestions for improvements will have material influence on the adjudication of the award.

All communications must be written on foolscap paper, on one side only, with an inch and a quarter margin. They must be accompanied by such drawings, models, or specimens, as may be necessary to illustrate the subject. The drawings should be on a sufficiently large scale to be seen from a distance when suspended on the walls of a meeting-room.

In regard to Colonial Produce of all kinds, it is absolutely necessary that a certificate from the Governor, or other qualified person, should accompany the samples sent to the Society, certifying that they really are the produce of the particular district referred to. The samples should be sufficient in quantity to enable experiments to be made, and an opinion to be formed of their quality; and it is desirable that the cost price in the district from which they are forwarded should be given. In every instance the probable extent of supply, with the average yield, if cultivated, and whether similar articles have hitherto been exported from the Colony, or not, and in what quantities, should be stated.

All communications and articles intended for competition must be delivered, addressed to the Secretary, at the Society's House, free of expense, either on or before the 31st of March, 1859, or on or before the 31st of March, 1860. In the first case they will be considered during the Session 1858-59, in the second case during the Session 1859-60. This restriction, as to the date of receipt, does not apply to articles of Colonial produce, in respect of which this list is valid until the 31st December, 1860.

Any communication rewarded by the Society, or any paper read at an ordinary meeting, will be considered as the property of the Society. Should the Council delay its publication beyond twelve months after the date of its being rewarded or read, the author will be permitted to take a copy of the same, and to publish it in any way he thinks fit.

Unrewarded communications and articles must be applied for at the close of each Session, between the third Wednesday in June and the last Wednesday in July, after which the Society will be no longer responsible for their return.

By order,
P. LE NEVE FOSTER, *Secretary.*
December, 1858.

PREMIUM LIST.

SPECIAL PRIZES.

Swiney Prize (Special).

Under the will of Dr. Swiney, a silver goblet, of the value of £100 sterling, containing gold coin to the same amount, is presented on every fifth anniversary of Dr. Swiney's death to the author of the best published Treatise on Jurisprudence.

The next award of this prize will be made on the 20th day of January, 1859.

The Society's Gold Medal (Special).

⁂ A donation by Benjamin Oliveira, Esq., having been placed at the disposal of the Council, to be awarded as a special premium, they have decided to offer the Society's Gold Medal.

For the discovery of a substitute for Cotton, to be produced in such quantities and at such cost as will render it available for commercial and manufacturing purposes.

Fothergill Prize (Special).

A Gold Medal.

⁂ This is offered in conformity with the will of the late Dr. Fothergill.

For the production of an Incombustible Paper, so as to render the ledgers of commercial men, bankers, &c., indestructible by fire.

Stock Prize (Special).

Silver Medallion.

⁂ This is offered in conformity with the will of the late John Stock.

For a design for an Institute, comprising a hall for lectures and music, two or three class rooms, a reading room, and a library, which must be in one or in communication, offices, and apartments for the librarian. The principal rooms should be so arranged that they may be easily used together for the purposes of exhibition. The plan must be suited for an Institution having two hundred members, and be capable of extension so as to meet the wants of Institutions having 1000 members. Provision must be made for lighting and ventilating the whole of the building. The design must be exhibited in the following drawings, which must be to a scale of $\frac{1}{8}$th of an inch to a foot:—

1. A general block plan.
2. A plan of each floor.
3. At least two elevations.
4. Sections showing the construction of all parts of the building.
5. An estimate of the cost.

N.B.—All the dimensions must be figured on the drawings.

GENERAL LIST.

⁂ The Society's gold and silver medals will be awardedfor communications on the following subjects:—

Classes I. to IV.*

1. For an account of the mode of occurrence, and of the uses of Cornish, Devonshire and Dorsetshire Clays, and the quantities annually worked.
2. For an account of the different Natural Stones, whether limestones or sandstones, used for architectural purposes in the different large towns in the United Kingdom, stating the comparative durability, price, special use, and general statistics of each together with suggestions for preventing decay.
3. For an account of the methods at present in use in the various coal-mining districts for ventilating and lighting the mines, with suggestions for their improvement.
4. For an account of the various commercial Copper Ores, of the smelting processes, and the methods by which the precious metals can be separated from Copper.
5. For the application of Silicium economically as an alloy with Copper.
6. For an account of the treatment of Tin, and its application to the Arts and Manufactures, and of recent discoveries of new sources of supply.
7. For an account of the modes by which *Wolfram* can be separated from other ores; and of the uses of Tungsten in the Arts.
8. For any new application of Tungsten in the Arts.
9. For an account of Menaccanite or Iserine, and suggestions for obtaining Titanium from these ores.
10. For an account of the processes now in use for Smelting Zinc Ores, with suggestions for their improvement.
11. For improvements in the process of condensing the Fumes in the Smelting of Lead Slags.
12. For the most ready and economical method of sepating Lead from antimony or antimony ores.
13. For the best account of the production of Sulphur and Arsenic from the metalliferous ores of the United Kingdom, with statistics of the use and export of these substances.
14. For an account of Mineral Veins in the various Mining Districts in the British Islands, with particular reference to the differences that exist between Copper and Lead lodes, and the relations of Copper with Tin, and of Silver and Zinc with Lead.
15. For an account of the methods now in use for separating Silver from Lead Ores, with suggestions for their improvement.
16. For an account of a new and economic means of producing Aluminium commercially, with suggestions of the purposes to which it may be employed with advantage.
17. For the discovery or manufacture of a new Smokeless Fuel, which shall not occupy more space, or be of greater weight than the fuel now in use; and shall be equal in the amount of heating power, without liability to injure metals in contact with it.
18. For a description of the manufacture of saltpetre, and its preparation for the market in the East or West Indies.
19. For the economical production of Cyanogen Compounds for employment in the Arts, or as manures.
20. For the production of Ammonia or Nitric Acid from their elements, by methods which would admit of practical application.

*** The classification of this list is that adopted at the Great Exhibition of 1851.**

21. For the best collection of Cinchona Barks, capable of elucidating upon analysis the question of the relative richness in alkaloids of the young and old barks of particular species. Such a collection must be formed in the bark districts of South America. The specimens must be accompanied by pressed and dried flowers, fruits, and leaves of the trees of which the barks are sent. Samples of bark must be of not less than 6 lbs. each.

22. For an account of the processes at present employed for the extraction of Dyes and Colouring Matters from animal, vegetable, or mineral substances.

23. For an account of foreign Dyeing and Colouring Substances, distinguishing those at present used from those generally unknown to Commerce.

24. For an account of the principal Dyes and Dye Stuffs at present employed in the woollen and silk trades, their sources of supply and modes of application.

25. For the production of a good and permanent Purple or Violet Dye for silk and other fabrics, by a process free from injurious effects upon those engaged in its production.

26. For an account of the principal Dyes and Dye Stuffs at present employed in the cotton trade, their sources of supply and modes of application.

27. For the production from coal of Colouring or Dyeing Materials, capable of being used economically as substitutes for indigo or madder.

28. For an economical means of increasing the purity and illuminating power of Coal Gas, and for a simple method of detecting and removing the sulphur compounds not shown by the usual Salts of Lead test.

29. For an Elastic Material for Tubing suited to the conveyance of Gas, and not liable to be affected by alterations in temperature, or to be acted upon by the gas itself.

30. For an economical means of supply and application of hydrogen gas for heating purposes.

31. For the best means of Utilizing Refuse Ores, Refuse Coal, and impure approximations to coal.

32. For the discovery of a practical means of utilizing Naphthaline.

33. For the discovery of a practical process for converting the refuse Naphthaline of Gas Works into Alizarine or Madder red.

34. For an account of the processes employed in obtaining different products (as Paraffine) from Shale, and the uses to which they may be applied.

35. For the best account of Coal, Shale, and other Mineral Oils applicable to illuminating purposes, and the best means of rendering them inodorous.

36. For the production of Glass by the use of the constituents of which the French sands are composed, such Glass to be of a quality equal to that produced from those sands.

37. For an account of the various materials, White Lead, White Zinc, and Carbonate of Barytes, used in the manufacture of white paint, and the advantages and disadvantages of each.

38. For a good and permanent bright green colour suitable for Paperhangings, which shall be free from the objections stated to exist in that prepared from arsenic.

39. For a green colour suitable for use, both in water and oil, which shall be more permanent and generally superior in quality to that known as "Brunswick" green.

40. For the preparation of any Colour, applicable to the japanned surfaces of Papier Maché, that shall be free from the brightness (or glare) of the varnished colours now used, but possess the same degree of hardness and durability.

41. For the production of a Blue similar to Prussian Blue, which either on cotton or otherwise, shall not be attacked by soap, or moderately dilute caustic alkalies, in the cold.

42. For the preparation of light colours to be used in Enamelling or Japanning Slate or Iron, which will stand the action of heat from the fire without blistering or discoloration, and be sufficiently hard to resist scratches.

43. For a cheap substitute for Pitch, Tar, &c., equally impervious to air and moisture, but non-inflammable.

44. For an account of Tanning Substances, distinguishing those at present used from those generally unknown to Commerce.

45. For an account of the materials and methods at present employed in preparing and dressing Skins, and the colours and treatments to which they are submitted in dyeing.

46. For an account of the methods at present practised in France and Russia for dyeing and dressing Morocco Leather.

47. For an efficient means of removing the fatty matters from skins, so as to render them capable of receiving mordants by the ordinary printing process.

48. For an account of the sources of supply of Furs, and of the methods of preparing, dressing, and dyeing them for the market.

49. For the introduction commercially of a supply of Hair for manufacturing purposes, obtained from animals not hitherto resorted to, such as the musk ox, &c.

50. For the best substitute for Horsehair, for stuffing cushions, mattresses, &c.

51. For an account of the sources of supply and processes of manufacture of the various Lubricants employed in working machinery and rolling stock.

52. For an account of the Spices of Commerce, with suggestions in reference to new sources of supply.

53. For the importation into this country of samples of Sugar, not less than 25 lbs. weight each, the produce of the Australian Colonies. Details of the extent of land cultivated, yield of sugar per acre, and cost of production per ton of sugar to be given.

54. For an account of Palms and similar trees which yield meal, saccharine and other juices, fibres, edible fruits, &c., with a statement of the cost and commercial value of their products.

55. For the best essy on the theory and practice of fermentation, particularly as applied to the art of brewing, with an account of any successful means by which the process of malting may be modified or dispensed with.

56. For an account of the processes employed in the manufacture of Starch, the sources from whence it is obtained, and the purposes to which it is applied.

57. For the largest and best sample of Starch, produced from a non-edible substance, as cheap as any at present in use, and obtainable in large quantities.

58. For the best and most economical means of applying Carbonic Acid Gas to the preservation of Meat.

59. For the production of a perfectly Colourless Copal Varnish, not liable to change or contract, or to injure the colours over which it is applied.

60. For a pure Colourless Oil suitable for Artists, or for a decolorising agent for linseed oil which will leave its other properties unimpaired.

61. For an account of the manufacture of Garancine, as now practised in France, commencing with the best processes for grinding the root to powder; with observations as to the modifications which might be necessary for rendering similar machinery available for grinding Indian Munjeet or Madder.

62. For the production of cheap Purple and Yellow Lakes, of good quality, suitable for carriage-builders, &c., and not liable to fade or change colour.

63. For the discovery of a substitute for wood blocks used by the wood engraver, so as to supersede the necessity of uniting several blocks.

64. For an account of the origin, development, and present condition of the Pearl Fisheries of Ceylon, the Persian Gulf, and the Gulfs of Mexico and Panama.

65. For an account of the Sponge or Coral Fisheries, with suggestions for the development of new sources of supply.

66. For an account giving the results of investigations into the nature and character of the various Woods, the produce of India and the Colonies, with a view to ascertain their value for local use in railways in those countries, as compared with the woods used in Europe; the most effective and economical means of preserving such material, when brought into use, against the destructive effects of extreme heat and moisture, and the ravages of white ants and other insects.

67. For an account of Animal Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, Natal, or New Zealand.

68. For an account of Vegetable Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, Natal, or New Zealand.

69. For an account of Mineral Substances, raw and manufactured, illustrating the natural resources of any one of the following British possessions:—The East or West Indies, Ceylon, Australia, Canada, the Cape Colony, Natal, or New Zealand.

70. For the best treatise on the Commercial Products of the Islands of the Eastern Archipelago, and their facilities and openings for trade.

71. For an economical method of rendering the refuse from Scrolls in making size, and the waste Alkali and filth extracted from rags in process of boiling, available each separately as a manure.

72. For an account of the means at present employed in the utilization of so-called "refuse products" generally.

Classes V. to X.

73. For the introduction of an economic system of Railway Transit applicable to common roads, so as to connect thinly populated districts with each other, and with the main lines of railways.

74. For the introduction upon common roads and in the streets of Towns of a cheap and effective system of Railways for goods and passengers.

75. For the economical application of Iron in the construction of railways in tropical countries, as a substitute for wood.

76. For the best method of preparing Pure Water for Locomotive Engines, either by distilling or otherwise, so as to prevent incrustation in the boiler, and the necessity for "blowing off," thus saving fuel and time.

77. For an account of the machinery and processes employed in the manufacture of Nails.

78. For an account of the machinery and processes employed in rolling metals into sheets, bars, and rods.

79. For an account of the best machinery for preparing, grinding and dressing Barley and Oats into their respective manufactured constituents, pearl Barley, Groats, &c.,

80. For a cheap and effective machine for cleaning and hulling Rice, so that it may be prepared and shipped at the seat of production in a marketable condition.

81. For an account of improvements in the manufacture and refining of sugar.

82. For an account of improvements in Consuming or Preventing Smoke in Dye Houses and Chemical Works.

83. For the best method of converting precipitated or extracted Sewage Matter into a dry state, valuable for agricultural purposes.

84. For the best and most convenient method of welding together the frame-work and covering of iron vessels for navigation, so as to dispense with bolting and riveting, thereby increasing the strength, diminishing the weight, and increasing the floating power.

85. For a system of light and sound Signals, for use in steam-vessels, to prevent collisions at sea in fog or darkness, and more effective than any hitherto known.

86. For an account of improvements in the construction and arrangement of machinery for spinning and doubling Cotton and other fibrous materials.

87. For an account of improvements in the machinery and processes employed in the Manufacture of Woollen Cloths.

88. For an account of improvements in the Machinery and processes employed in the manufacture of Silk Fabrics.

89. For a mechanical substitute for hand labour in running in the outline to the figures in machine-wrought lace.

90. For the best mode of finishing the edges of machine-made Bobbin Lace (in imitation of pillow lace), so as to supersede the use of the separate pearl edge, usually sewn on.

91. For improvements in machinery for weaving Lace, whereby the outline of the pattern produced shall be worked simultaneously with the production of the fabric, without the intervention of hand labour.

92. For a Bobbin for Silk which shall possess exact uniformity of weight, shall be incapable of being made heavier without detection, and which will not absorb moisture. The material employed must not be liable to chip, or to affect the colour of the silk wound on it.

93. For a Machine to serve as a substitute for hand-labour in cutting the pile of silk Velvets and similar fabrics.

94. For an account of the machinery and processes other than hand-labour employed in the production of Embroidered Fabrics.

95. For a Composition for Feeding-Rollers for Printing Paper Hangings by cylinder machinery, similar in consistency and texture to the gelatine rollers used in letter-press printing, but adapted for working in water colours.

96. For an account of improvements in the modes of printing, including the manufacture of Types, Stereotyping, and Printers' Plant in general.

97. For a rapid means of reproducing Artistic Designs or Sketches, without the intervention of hand labour, for surface printing by machinery.

98. For an effectual and economical means of producing Steel or Copper Plates or Surface Blocks by the action of Light, Electricity, Magnetism, or otherwise.

99. For a rapid means of Reproducing Artistic Designs or Sketches, and also for Reproducing Copper-plate Engravings (from the plate or from the impression) for Surface-printing by Hand-press or Machinery, without the intervention of Hand-labour.

100. For an essay on mechanical and other contrivances for Reducing, Enlarging, Copying, and Reproducing Drawings, Maps, &c.

101. For a portable instrument capable of showing the velocity of movement of fluids in closed pipes, adapted for insertion through a stop cock, and possessing a statical indication.

102. For an instrument which shall be applicable to determine the velocity of sub-aqueous currents at considerable depths, with or without the necessity of being brought to the surface to be read off.

103. For the discovery of any simple and efficient apparatus for detecting and registering impure states of the atmosphere, either in mines or in over-crowded and ill-ventilated buildings.

104. For the discovery of a Galvanic Battery for Electromotive machines and other purposes, capable of producing greater results, and at a cheaper rate than any hitherto known.

105. For the production of an efficient means of carrying out the system of Oceanic Electric Telegraphs between distant countries. The plan must insure perfect insulation, *a minimum* of resistance to the current sent, rapidity of communication, the use of a minimum power, freedom from liability to injurious action either from air or water, and a power of resisting mechanical strains.

106. For the production of a covering for the wires of Electric Telegraphs with a vitreous non-conducting coating, which shall be capable of resisting the ordinary wear and tear of telegraphic lines, atmospheric influences, acids, and sea-water.

107. For the discovery of a natural or artificial substitute for Gutta Percha, possessing, amongst others, the following properties:—It must be insoluble in water, a perfect non-conductor of electricity, as flexible and as easily worked as Gutta Percha, firm at a temperature of 150°, but soft and plastic in boiling water, and weldable at 212°.

108. For any new and simple method of producing works of Art in the compound metal bronze, or other metals, either by improved methods of casting, in the material employed as moulds, or by electro deposit.

109. For the invention of a simple Electrometer, to be sold at a moderate price, for determining the amount and kind of atmospheric electricity; and which will show uniform results under uniform circumstances.

110. For the invention of a Self-registering Electrometer showing the kind as well as the amount of electricity.

111. For a Self-registering maximum or minimum Hygrometer.

112. For the invention of a Marine Mercurial Barometer, which will obviate the oscillation of the mercury, and fulfil all the conditions necessary to make it a good and reliable instrument.

113. For the invention of an Anemometer, for measuring the force and direction of the wind on board ship correctly, distinguishing the amount due to the wind and that due to the ship's velocity, varying with the angle.

114. For a machine that will satisfactorily determine great depths at sea by compression, free from the errors of absorption of air, if that be employed, or from the inequalities of a spring, if that be used; and upon a scale of sufficiently large dimensions throughout to be practically useful and correct.

115. For an instrument that will detect the Local Attraction of a ship at sea with reference to the compass, by direct observation of the heavenly bodies, *without* the process of turning the ship.

116. For an Artificial Horizon that can be practically employed at sea, to be used with a sextant, and which will enable the altitude of a heavenly body to be taken with sufficient accuracy for the purposes of navigation.

117. For a Self-registering Minimum Thermometer for great depths at sea, that will not be deranged by checking and hauling up the line, or by the pressure of the water on the bulb, and that will give the minimum of temperature passed through.

118. For the invention of a Mercurial Self-registering Minimum Thermometer.

119. For a ready means of combining the Practice of Great-circle Sailing with the Principles of Physical Geography.

120. For the production, in a reliable form, of Maps on a spherical surface which will be portions of globes fit to be suspended on walls or laid on a table, or for use on board ship in place of Mercator's charts.

Classes XI. to XXIX.

121. For the economic production of articles of outer clothing, woven in the loom, so as to economise the cost of production, and reduce the amount of hand labour.

122. For the best specimens of Woollen Velvets and Velveteens, of a moderate price, not liable to fade or become rusty, and especially suitable for the furniture and the interior of carriages.

123. For an account of an improved method of transferring the pattern from the original design to the Jacquard Loom.

124. For an economical means of producing figured patterns in the Loom by means of Electricity.

125. For a means of producing by the electrotype process a gilded pattern or portion of a pattern on textile fabrics, or of gilding the fibre previous to weaving.

126. For the successful application of some new means (as Electricity or Photography, for instance) for producing Ornamental Coloured Designs in Woven Fabrics, which shall be cheaper and easier of application than those at present employed.

127. For the best series of Tinted Writing and Packing Papers coloured in the pulp, made from materials not suited for the manufacture of white paper.

128. For the best method of Colouring Paper in the pulp with indigo, and with greens of various hues, the colours not to be liable to be affected by gases.

129. For a method of more thoroughly Sizing Machine-made Papers with Animal size.

130. For an account of the processes at present used in the re-conversion of Woollen or Mixed Woollen Rags, with specimens illustrative of the manufactures in which they are or may be employed.

131. For an account of the machinery and processes used in cutting, working, and embossing veneers in imitation of carved work.

132. For the best essay on Ancient Goldsmiths' Work.

133. For an account of any new and improved processes for economically producing vitreous reflecting surfaces applicable to Lighthouses, or for general purposes.

134. For an account of the processes and materials employed in Chromatic Painting on Glass, Porcelain, Clay, Lava, and materials susceptible of vitrification, or capable of receiving an enamelled surface.

135. For a chemical means of Engraving on Glass and Crystal, avoiding the injurious fumes of fluoric acid, and producing finely detailed designs.

136. For a Chemical or Mechanical process for fixing or engraving the collodion photographic image on its plate of glass, so that it may be employed ornamentally in windows, &c., or as a matrix for obtaining impressions on paper.

137. For a process for transferring to Porcelain, Photographic images which may be permanently fixed by being burnt in, or enamelled on the surface.
138. For an essay on the manufacture of Earthenware Pipes and Stone Ware in general, with an account of the improvements introduced in the construction of the Kilns used in burning such wares.
139. For an account of the various Artificial Stones and Terra-Cottas introduced and employed for purposes of construction, stating their properties, advantages, and imperfections, and their relative cost as manufactured, both inclusive and exclusive of loss by breakage in the kiln.
140. For the production of Paperhangings printed from blocks by machinery, thereby enabling a larger number of colours and increased surface to be worked economically.
141. For the production of Paperhangings in which effects are economically produced by the action of chemical re-agents in the body of the paper, as is the case in photographic processes and in calico printing.
142. For an account of processes at present employed in the preparation of Artificial Perfumes and Essences.

143. For an essay on Evaporation, Condensation, and Refrigeration, with the results of systematic experiments, and the economical results, both as to time, fuel, and surface, the comparative degrees of heat used and produced, and a comparison of those results with theoretical maxima.
144. For a connected series of practical observations on Natural or Atmospheric Evaporation, as taking place from the surface of cultivated or uncultivated land, and a comparison of the same with the local rainfall.
145. For an essay on the various branches of Industry which are known to be unhealthy, pointing out the causes of their injurious effects, with suggestions for prevention or relief.

ON ARSENICAL PAPER HANGINGS, AND THE MODE IN WHICH THEY PRODUCE NOXIOUS EFFECTS ON HEALTH.

By Alfred S. Taylor, M.D., F.R.S.

A friend, whose library walls were covered with an arsenical paper, had suffered for some time from chronic inflammation of the eyes, especially affecting the conjunctivæ of the eye-lids. On the discovery that arsenic was contained in the green pigment of this paper in rather large quantity, he caused it to be removed during the summer, and to be replaced by another containing no arsenic. The inflammation from which he had suffered disappeared; but within the last few weeks it has returned. He informed me that he had been dusting some books in a book-case in this room, and he supposed that the dust which had accumulated for two or three years had affected his eyes, and had caused a return of the inflammation. Some of the dust was carefully removed, on Tuesday last, from the tops of a few books, by a feather, and submitted to a chemical analysis. The dust weighed one grain and a half; it had an olive-green colour; and under the microscope it presented the appearance of fibres, with numerous particles of various colours, chiefly of a greyish black. Treated by Reinsch's process, a portion of this dust yielded a deposit of arsenic, and there was therefore clear evidence that some of the arsenical pigment formerly on the walls, had found its way through the glass doors of the book-case, and had been deposited in the form of a fine dust on the tops of the books.

On Thursday last, after having made this chemical examination of the dust from a private dwelling, I procured from the shop of Messrs. Marratt and Short, opticians, 63, King William-street, London-bridge, a quantity of dust for the purposes of analysis. The walls of this shop are covered with an unglazed arsenical paper, and, as I am informed, they have been so covered for a period of three years. In collecting this dust from the tops of the instrument cases, great care was taken not to touch the walls. The quantity thus collected for examination amounted to about four hundred and fifty grains. It was nearly black, and under the microscope it appeared to consist of fibres and sooty particles. It was very light and flocculent. One hundred and fifty grains of the dust were examined by Reinsch's process, and enough metallic arsenic was obtained from this quantity to coat about ten square inches of copper-foil, in addition to a piece of copper-gauze. From the deposit on the latter, by the application of heat, octahedral crystals of arsenic were readily obtained. The cases had not been dusted for a period of nine months.

The instrument cases are secured by glass doors, and they are lined inside at the back with arsenical paper. A small quantity of dust was removed by a camel's hair pencil from the projecting portions of the thermometers and barometers which are kept there. The quantity thus obtained weighed about eight-tenths of a grain, of which five-tenths were taken for examination. This half-grain of dust sufficed to cover with metallic arsenic a square inch of copper gauze; a portion of this, when heated, yielded a large number of well-defined octahedral crystals of arsenious acid.

These facts lead to the inference that the air of a room, of which the walls are covered with an unglazed arsenical paper, is liable to be charged with the fine dust of the poisonous arsenite of copper. Those who inhabit those rooms are exposed to the risk of breathing this dust. The poison may thus find its way by the pulmonary membrane into the system, or it may affect the eyes, nose, and throat by local action. That few cases of actual poisoning, under these circumstances, have occurred, is a fortunate circumstance; but cases involving serious symptoms only would be likely to attract attention. There may have been numerous instances of a disturbance of health, depending on this assenical paper, which, from absence of suspicion, has been referred to other causes. The degree of exposure—the state of health—peculiar susceptibility and the eliminating power of the system may account for the comparative rareness of these cases. The mode in which the pigment is laid on the paper may be such as to prevent, in some instances, the escape of fine particles of dust. The fact, however, now demonstrated, that arsenical dust is breathed by those who occupy rooms thus papered, explains the similarity of symptoms observed,—justifies the statements made by Dr. Hinds, Dr. Halley, and others.—and proves that those who have experimented on this subject with negative results, have not taken the right course to arrive at the truth. Their results have, to a certain extent, misled the public, by teaching them to rely on what is now proved to be a false security. If, as a general rule, the quantity of arsenic which can penetrate the body from this source is small, it is still desirable that arsenic should not be breathed day by day in any proportion. The defenders of this noxious manufacture will hardly go the length of asserting that this arsenical green, which is a potent poison in the stomach, can exert no injurious effect when taken into the lungs; and yet, unless this assumption be made, the inevitable inference is that these papers should not be used for covering the walls of our dwellings.

15, St. James's-terrace, Regent's-park,
December 29, 1858.

WIGAN MINING AND MECHANICAL SCHOOL.

A school is to be opened for the purpose of giving the colliers, operatives, and others of the working classes, in the town of Wigan and the district, the means of acquiring elementary scientific instruction, more particularly in those subjects immediately bearing upon local industry.

This will be done by means of classes, held in a room at the Mechanics' Institution, which has been fitted up for the purpose, and where an extensive collection of chemical and mechanical apparatus, together with the models of steam engines, and other machines, has been provided for the use of the scholars. The master of the school has been selected by the Government Department of Science and Art, and has a certificate from the School of Mines in London.

All candidates must be fifteen years of age, and must be able to read and write, and know the simple rules of arithmetic. Those who require to be taught these subjects, may learn them by becoming members of the evening classes of the Mechanics' Institution.

The course of instruction in the Mining and Mechanical School will extend over one year, and will embrace the following subjects:—

Mining.

1.—Detailed discussion of known facts connected with the deposits of coal and cannel, and other minerals, beds, strata, or seams, faults, &c.

2.—Preliminary research; boring, as practised with different apparatus, with rods or rope, and with various cutting and clearing instruments.

3.—Tools employed in mining—blasting by various methods.

4.—Mode of lighting mines, including a comparison of the various sorts of safety lamps.

5.—Shafts and levels—sinking and driving.

6.—Means of securing excavations by timbering, masonry, and tubbing; construction of dams.

7.—The getting and working of the minerals.

8.—Carriage and transport of minerals by underground roads.

9.—Winding or raising in the shafts, with the machinery and apparatus required.

10.—Pumps and pumping engines.

11.—Ventilation, its principles and practice; natural ventilation, artificial, introduction of a moving power, distribution of air through workings, explosions, and the mode of detecting and dispelling noxious gases.

12.—The making of colliery plans, and the use of the dial and level.

The Principles of Geology and Mineralogy.

Mechanics.

1.—Lectures on heat, electricity, the telegraph, and mechanical powers.

2.—Applied—the principles of the above being shown in their relation to the steam-engine, boilers, and machinery, and illustrated by working models.

3.—Mechanical drawing.

Chemistry.

Theoretical—by means of lectures, in which attention will be called to the abstract discoveries of the science, and also to the condition of water supply for domestic purposes, purification of water, gunpowder, bleaching powders, and dyeing, mortar and cement. The manufacture and purification of coal gas. Particular attention will also be directed to the different gases, especially those met with in coal mines.

The classes meet on Monday, Tuesday, Wednesday, and Friday evenings, from 7 o'clock to 9, the terms being 6d. a-week; members of the Mechanics' Institution are admitted at half-price.

The course commences on the 1st March, 1859, but preparatory lectures, on mechanics, chemistry, and arithmetic are now being given.

GEOLOGISTS' ASSOCIATION.

A meeting was held at Messrs. Barton's rooms, in Upper Wellington-street, Strand, on Friday evening, December 17, for the purpose of organising a new society, to promote the study of geology and its allied sciences. The means proposed are—the holding of periodical meetings for reading and discussing papers, and the exhibition of specimens; arrangements for facilitating the exchange of specimens between distant members; the formation of a typical collection of fossils suited to the wants of students; a library of reference; and the delivery of short courses of lectures. It was announced in the course of the proceedings that 120 applications for membership had already been received. The first meeting for actual work will take place early in the new year, when more detailed plans will be stated, and an inaugural address delivered by the president.

NEW WEIGHTS.

The *Liverpool Albion* states that the new weight, equal to 100lb. avoirdupois, to be called the "Cental," will be adopted exclusively for all transactions in the Liverpool Corn-market on and after the 1st of February next, all other weights, except for minor portions of the "cental," and all measures of every kind whatever, being from that date excluded. At Hull, likewise, it has been resolved to adopt the "cental," not only for all grain, flour, and meal, but for seeds also; and Wakefield and Leeds are expected to concur in the movement.

Home Correspondence.

THE SUPPLY OF COTTON.

Sir,—Mr. Clegg, the chairman of the late meeting on the Cotton Paper of Mr. Wray, seems to possess more common sense, as well as humanity, than the generality of his townsmen. He imported Africans to work in his mills. The history of how this was set about would be very interesting to all the readers of this Journal, and also what the results were, whether the African fingers were as well-adapted to cotton as those of the ordinary mill-workers, whether they were diligent, industrious, and well-conducted, and whether they earned wages, and what amount, and whether it would not pay mill-owners generally to import them and then let them go back to their own country to spread civilisation, perhaps ultimately to set up mills with English machinery, as well as to grow cotton. If this could be done, it would rapidly set the Americans to work to supersede the use of slaves by machinery. I can conceive nothing more desirable or more likely to aid civilisation all over the world than the importation of the natives of all countries into England to behold with their own eyes the results of freedom and industry. And Africa, especially, is so close to our own doors that our teaching can be done to our own profit, and in time an allied nation may grow up prepared to aid us in our continuous struggle for their freedom, and to close the door against the domination of taskmasters, importing them to the tropics—another name for slavery. I trust that Mr. Clegg will let us know that he means to introduce more Africans, for no one would suppose that bringing Africans to England has any tendency to make their condition worse, but on the contrary. We hold the best part of Africa as a colony on the south. Dr. Livingston is founding a new colony in Central Africa, and doubtless time will show how the Atlantic coast is to be drained and made wholesome, or, at least, how we may safely pass through the coast-poison at all times to the interior. Very valuable to the community is the work doing by the Society of Arts. But for this, we should now be lacking the important knowledge we have obtained from Mr. Clegg and Mr. Wray.

I am &c., W. BRIDGES ADAMS.

MR. REED'S PAPER ON THE SHIPS OF THE ROYAL NAVY.

Sir,—In common with all those who have either read or heard read Mr. Reed's valuable paper on the "modifications which the ships of the Royal Navy have undergone during the present century, in respect to form, dimensions, means of propulsion, and powers of attack and defence," read at the Society's meeting of the 15th inst., I beg leave to join in the thanks awarded to Mr. Reed by the Society. I am not surprised that amongst the numerous topics therein mentioned, Mr. Reed should have omitted the dates of several important facts, and the names of those to whom the introduction of certain improvements into the Royal Navy is due. In order to supply some of these omissions, I beg leave to make the following observations:—As far back as the year 1790, the late Mr. Rennie entered into correspondence with the late ingenious Earl Stanhope, pointing out how the improved patented steam-engine of Watt could be applied in the most advantageous manner for the propulsion of vessels, either by the cylinder being placed vertical, horizontal, or inclined. In 1818, he recommended the corporation of Edinburgh to adopt steam vessels for towing, or that they might be constructed for the double purpose of towing and dredging if required. Long previous to this, Mr. Rennie had constantly urged upon the Admiralty the absolute necessity of introducing steam vessels into the Royal Navy; but, although the late Lord Melville, then first Lord of the Admiralty, was fully convinced of the importance of the invention, and the propriety of following Mr. Rennie's advice, nevertheless the prejudices and opposition of the officers under him were so strong that he was for a while obliged to defer to them. At last Mr. Rennie prevailed upon his lordship to permit him to hire a steam vessel to tow one of His Majesty's vessels of war, being fully convinced that the result would overcome all objections. This memorable experiment took place on the 4th of June, 1819, under the direction of Mr. Rennie in person, accompanied by the late Mr. Oliver Laing, afterwards master-shipwright of Woolwich dockyard, whom Mr. Rennie had imbued with the same enthusiasm for steam-vessels as himself. The vessel selected to be towed was the *Hastings*, of 74 guns, and the towing steam-vessel was the *Eclipse*, a Margate steam-boat, one of the first. This vessel was 117 ft. long, 21 ft. wide, and drew 4 ft. 10½ in. water. The paddle-wheels were 16 ft. diameter, and 6½ ft. wide, and were worked by a pair of steam-engines of the nominal power of 30 horses each, or 60 horse-power together. Mr. Rennie gave the result of this trial in a long detailed report to the Admiralty, showing that the *Hastings* was towed by the above-made steam-vessel fully four miles an hour against tide, *by steam alone*. In other respects the experiment was most satisfactory, and convinced everybody present of the importance of the invention, and the absolute necessity for introducing steam-vessels without delay into the Royal navy. The *Hastings* was towed from Woolwich Dockyard to Gravesend church, and would have been towed to Sheerness, but the proprietors of the steam-vessel would not go lower down, as it would have interfered with their business on the Margate station. This may fairly be considered the first introduction of steam into the Royal Navy. The Admiralty then determined to construct a steam-vessel for their navy, and Mr. Laing was employed for that purpose. The result of this was the *Comet*, in 1820, in the construction, general dimensions and power of which Mr. Rennie's advice was in a great measure adopted. The *Comet* therefore, may properly be considered the first steam-vessel belonging to the Royal Navy. Mr. Rennie died in 1821. Had he lived there is very little doubt but that the progress of steam in the Royal Navy would have been more rapid, as he was very enthusiastic upon the subject, and his advice was listened to with great respect.

In 1837, in consequence of the success of Mr. T. P. Smith's screw-propelled vessel, a company was formed to carry the invention into effect upon a large scale; and my brother, the present Mr. Rennie, and myself, being fully impressed with the importance of the invention, and that it would of necessity ultimately supersede the paddle-wheel, at least for vessels of war, subscribed largely to the company, and constructed the steam-engines and machinery for the *Archimedes*, 232 tons, and 125 ft. long, 21 ft. 10 in. beam, and draught of water about 9 feet. The engines were in some measure direct-acting, and of 80 h.p. The propeller shaft was driven by gear, and made 133·3 revolutions per minute. The propeller was 5ft. 9 in. diameter, and 8 ft. pitch, and propelled the vessel through water nine miles an hour. The complete success of the *Archimedes* took the mechanical world by surprise, although considerable doubts and difficulties as to its ultimate success were expressed in many quarters. My brother and myself had no doubt whatever upon the subject, and determined to proceed in urging it forward by every means in our power. The *Archimedes* was completed in the summer of 1839. Soon afterwards I waited upon Sir George Cockburn, then senior Naval Lord of the Admiralty, and pointed out to him, in the strongest manner possible, the advantages of stern propelling, and the absolute necessity of introducing it into the Royal Navy without further delay, as it must of necessity supersede the paddle-wheel in vessels of war.

Sir George Cockburn listened with the greatest attention to all I said, and at first expressed considerable doubts as to its success. At last, in the name of my brother and myself, I offered to provide a vessel of a certain size, propelled by a screw, with engines and machinery complete, capable of carrying a suitable armament with a corresponding crew, provisions, and munitions of war, which should have a speed of ten knots an hour *through the water*. No money was to be advanced or paid until the proposed conditions had been strictly fulfilled, and the price to be paid was then to be determined by the Admiralty officers, and if the Admiralty did not approve of her, we would take the vessel back without any charge. The confidence with which the proposal was made, and the fairness of terms, at once struck Sir George Cockburn as an omen of success; his doubts vanished, and at his recommendation the proposal was at once accepted by the Admiralty. The result was the completion of the *Dwarf*, in 1840, 210 tons, with engines of 120 h.p., in some measure similar to, but an improvement upon, those of the *Archimedes*, propelled by a screw of the requisite size. The *Dwarf* attained a speed of fully 12 miles an hour, which was more than we promised; she proved herself to be an excellent sea-boat, and fully answered every expectation, and was of great use as a dispatch boat between England and Ireland during the stormy and eventful winter of 1840-41, when the O'Connell rebellion was threatened. This was, I believe, the first introduction of the screw into the Royal Navy. Its subsequent success needs no comment, but more than amply justifies all the arguments we used in favour of its introduction. The late scientific Admiral, Sir David Milne and myself, some short time afterwards, proposed to apply the screw to line-of-battle-ships and floating batteries for the protection of harbours; this was subsequently carried into effect, and now the triumph of the screw may be said to be almost universal.

I am, &c.,

JOHN RENNIE.

London, 27th Dec. 1858.

Sir,—In the discussion which followed the reading of Mr. Reed's valuable paper on Wednesday, there hardly seemed to be a proper opportunity to notice one point which appears worthy of some remarks.

The progress made in our own navy, and the comparison between the navies of different countries at the present time, cannot be accurately understood so long as the capacities of ships-of-war are indicated merely by the number of guns, horse-power of engines, and tonnage of the vessels, as these elements are calculated or given by mere haphazard now-a-days. It is extraordinary that men will continue to compare the tonnage of vessels, as if a proper standard were actually in use, when it is generally acknowledged that the engine power and tonnage capacity are both estimated by a calculation wholly illusory. The committee lately re-appointed by the British Association on this subject (with modified objects and powers) will probably recommend some better means for estimating the relative strength of navies, but meanwhile there is actually no reliable criterion of the tonnage of men-of-war (omitting the engine power for the present), and we find that all international comparison is accordingly deceptive.

For instance, the Turkish ships destroyed at Sinope included several of enormous tonnage (as reported); and yet I recollect when visiting these vessels before the battle, that several were obviously overrated a hundred per cent. It was *convenient* for the Turks to say they were of 4,000 tons register.

Again, a large Russian vessel was launched a few months ago at New York, and I found the Americans who built her published her tonnage at 6,000. It was then *convenient* for her builders to proclaim the enormous size of this vessel, the *General Admiral*, and yet her dimensions, when carefully compared with her nominal capacity, seemed to be strangely at fault. The American *Niagara* is often stated to be 5,000 tons register, but a comparison of her actual dimensions with those of the steamer *Persia*, of the Cunard line, makes one nearly sure that the *Persia* is decidedly superior in capacity, as she certainly is in power and speed.

Again, the Russians in America published an account of the Russian vessel refitting at Bordeaux, from which one might suppose she was almost a *Leviathan;* yet an inspection of the hull itself in the French port showed me that the description was grossly exaggerated.

Here, then, we have Turks, Russians, and Americans all publishing inaccurate statements, and perhaps "Britishers" also do the same. This practice will never be discontinued until some of the great nations, if not all of them, agree to estimate the tonnage of vessels according to a proper standard.

With respect to the steam-ram prodigy now building in New York, I may be allowed to confirm Mr. Scott Russell's statement, by mentioning that the slightest allusion to this affair is received in New York with a good-humoured smile, and that shrug of the shoulders which pantomimes the word "job."

We are evidently, therefore, in great need of some improved method of measuring the capacities of large vessels as a recognised standard upon which international comparisons may be based. And there is almost as much required in relation to the weight of metal which each ship-of-war really possesses, the number of tons of iron which could be discharged in a certain time, with a certain range.

One of the most valuable merits of Mr. Reed's paper deserves to be particularly noticed, as it was no doubt peculiarly remarkable, and that is the fairness with which praise was bestowed in it upon Government proceedings when they are good, while the shortcomings of official doings were also freely blamed.

I am, &c.,
JOHN MACGREGOR.

Temple, Dec. 17, 1858.

Proceedings of Institutions.

Dorking Literary and Scientific Institution.—A lecture on "Aquaria and Vivaria, regarded as Educational Instruments in Natural History," was delivered on Friday evening, the 3rd inst., by Samuel Highley, Esq., F.G.S., F.C.S. &c., vice-president; George Cubitt, Esq., vice-president, in the chair. The lecturer commenced by alluding to his desire, on taking up his residence in the neighbourhood, to found, with the assistance and co-operation of the gentlemen of the district, a Local Museum of Natural History, in connection with the Dorking Literary and Scientific Institution—that a separate fund had been established for the support of the Museum, which had already been liberally contributed to by the president and some of the vice-presidents, and that specimens and collections were pouring in so that an extension of the cases was already a matter of necessity. After pointing out the value of Museums to towns, he stated that the lecture might be regarded as the first of a series of occasional demonstrations on the contents of the Museum, and that his object would be to impart to his hearers sound and complete information on the subject under consideration, and that, beginning with the more elementary objects in the Museum, he intended gradually to lead upwards to the higher branches of natural history. As honorary director of the local Museum, he proposed making a general feature of Aquaria and Vivaria. He described the various forms of Aquaria, pointing out what plants, animals, &c., should be employed in maintaining the necessary balance of organic nature, both in marine and freshwater Aquaria, and the various precautions to be observed in their proper management, especially referring to the influence and stimulating power of light on vegetable growths, and the necessity of moderating the amount admitted to a much greater extent than was usually done. He then considered Aquaria and Vivaria in their educational relations, and showed, by coloured diagrams, how far representations (or types) of the great divisions of the animal kingdom could be employed to this end. After showing the implements necessary in shore collecting, and the dredges, nets, &c., employed for obtaining the various forms of life found in the sea, he proceeded to describe the kinds of animals to be met with in calm weather and after storms, and in what positions they could best be sought after. The lecturer then recommended his audience to watch the progress of the Aquaria and Vivaria shortly to be placed in the Museum, and concluded by thanking them for their courteous attention to his remarks.—The lecture was attended by a numerous and influential auditory, and many encomiums were bestowed on the beautiful and artistic arrangement by Mr. Highley, of the numerous marine and freshwater Aquaria, Natural History specimens, diagrams and apparatus necessary for the illustration of the subject. A vote of thanks was proposed by the chairman to Mr. Highley, and a like compliment was paid to Mr. Cubitt though Mr. Maybank.

Hanley (Potteries Mechanics' Institution).—On Tuesday, 21st instant, Dr. Charles Mackay, the well-known poet, delivered, in connection with this Institution, an interesting lecture on "Popular, National, and Historical Song, and the functions and influence of the Song Writer." The lecturer claimed for songs an important place in the literature of a nation, as moulding its fortunes by the great influence they exert in forming the opinions and character of the people. As notable examples, Dr Mackay quoted the famous song, commencing "And shall Trelawny die?" the English "National Anthem," the "Carmagnole," the "Marseillaise," and others. Burns's song, "A man 's a man for a' that," had, the lecturer said, in his opinion, inculcated, more powerfully than any other composition of the same length, the manly virtues of self-respect and self-reliance. Dr. Mackay closed his lecture by reciting two poems of his own, on the old subject, "ever new," of love. After the lecture, Mr. T. L. Emery, a gentleman of considerable local reputation as a vocalist, gave, with much effect, several of Dr. Mackay's songs, including "There's a good time coming," the audience joining in the chorus.

To Correspondents.

Erratum.—In the *Journal* for December 10th, page 54, col. 2, line 38, for "10 miles an hour" read "one mile an hour."

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Entomological, 8.
Tues. ......Royal Inst., 3. Prof. Faraday, "On Metalline Properties —Strength, Welding, Magnetism, &c."
Pathological, 8.
Photographic, 8.
Wed. ......Geological, 8.
Pharmaceutical, 8.
Royal Soc. Lit., $8\frac{1}{2}$.
Thurs. ...Royal Inst., 3. Prof. Faraday, "On Metalline Properties —Three States, Alloys, &c."
Royal Soc. Club, 6.
Royal, $8\frac{1}{2}$.
Fri.........Archæological, 4.
Sat. ......Asiatic, 2.
Royal Inst., 3. Prof. Faraday, "On Metalline Properties —Voltaic Battery, &c."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December* 24, 1858.]

Dated 22*nd October*, 1858.

2360. E. Whitehall, Bromley-place, Nottingham—Certain imp. in machinery for the manufacture of cap fronts.

Dated 13*th November*, 1858.

2548. J. Taylor, Birkenhead—Imp. in portable steam engines.

Dated 17*th November*, 1858.

2588. M. Scott, 3, Stanhope-terrace, Hyde-park-gardens—Imp. in the construction of breakwaters, parts of which are applicable in making other structures.

Dated 19*th November*, 1858.

2626. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction of electric telegraph cables or conductors. (A com.)

Dated 27*th November*, 1858.

2696. J. Ramsbottom, Accrington, Lancashire—Imp. in machinery or apparatus applicable to water meters, and to indicating and regulating the flow and pressure of fluids generally, and in obtaining motive power from the same.

Dated 3*rd December*, 1858.

2762. T. Bailey, 17, Russell-street, Birmingham—A mechanical movement applicable to loading fire-arms, and other purposes.
2764. G. E. Noone, 28, Hodson-street, Frances-street, Newington Butts—Certain imp. in machinery for generating gas from coal.
2768. C. F. Vasserot, 45, Essex-street, Strand—An improved apparatus for ventilating mines or other similar purposes. (A com.)
2770. H. Bevan, Shrewsbury—New or improved machines for effecting or facilitating arithmetical operations.

Dated 4*th December*, 1858.

2772. R. Legg, 11, Ashby street, Clerkenwell—A machine for combining the operation of compressing and cutting tobacco during the process of manufacture.
2774. J. B. Fisher and J. Fisher, Stourbridge, Worcestershire, and J. Bird, jun., Kingswinford, Staffordshire—An imp. in the doors and dampers of furnaces, and other places where intense heat has to be resisted.
2776. E. A. Servier, Paris—Imp. in pressure and fluid level indicators.
2778. A. Smith, J. Townsend, and E. W. Williams, Birmingham—An imp. in breech-loading fire-arms.
2780. J. Turner, 8, Lavender-grove, Queen's-road, Dalston—Imp. in the construction of chairs.
2782. J. L. Norton, Belle Sauvage yard, Ludgate-hill—Imp. in machines for stretching and drying fabrics, and in drying wool and other fibres.
2784. W. E. Newton, 66, Chancery-lane—Certain imp. in grain and grass harvesting machines. (A com.)
2786. T. R. Harding, Leeds—Imp. in combs, gills, hackles, and similar implements used in silk, wool, and flax machinery, and in the method of making the same.

Dated 8*th December*, 1858.

2811. C. de Cappot and A. Jarriant, 10, Route de la Révolte, Neuilly-sur-Seine—A new hydraulic counter.
2813. M. Henry, 84, Fleet-street—Imp. in twisting fibrous materials, and in machinery or apparatus employed therein. (A com.)
2815. A. Lamb and W. A. Summers, Southampton—Improved arrangements of apparatus for superheating steam.
2817. C. M. Westmacott, Arboretum-street, Litchurch, near Derby—Imp. in the permanent way of railways.

Dated 9*th December*, 1858.

2819. R. L. Burrowes and J. Knowles, jun., St. Helens—Certain imp. in the construction of pianofortes and organs.
2821. H. Maudsley, 4, Cheltenham-place, Lambeth—Improved glass and other vitreous vessels.
2823. H. Bell, Belfast, Ireland—Imp. in musical instruments.
2825. J. Elder, Glasgow—Imp. in paddle wheels.
2827. T. Allen, Clifton, Bristol—Imp. in folding bedsteads.
2829. H. Wilson, Norton, Durham—Imp. in the construction of pumps.
2831. B. Lauth, Morley's Hotel, Trafalgar-square—An improved mode of manufacturing rods and shafts.

Dated 10*th December*, 1858.

2833. J. Lightfoot, Accrington, Lancashire—Imp. in printing or staining yarns, fabrics, or fibrous substances, and in the manufacture of certain compounds for that purpose.
2835. A. Barclay, Kilmarnock, N.B.—Imp. in electric, magnetic, and electro-magnetic telegraph ropes or conductors.
2837. C. Hodgson, Ballard Rathdrum, Wicklow, Ireland—Imp. in the manufacture of fuel from peat, and in apparatus employed therein, part of which is also applicable to the moulding of bricks, tiles, and other plastic materials.
2839. G. F. Wilson, Belmont, Vauxhall—Imp. in the manufacture of lubricating oils.

Dated 11*th December*, 1858.

2841. W. F. Hall and T. Dutson, Saint Paul's-square, Birmingham—Certain imp. in fancy buttons for ladies' and gentlemen's wear.
2843. S. Dudgeon, Sheffield—An improved gas regulator.
2845. P. Robertson, Sun-court, Cornhill—Imp. in shuttles. (A com.)
2847. M. Schaffner, Eisenach—Imp. in smelting zinc ores, and in furnaces employed for this purpose.
2849. A. Rollason, Birmingham—Imp. in the manufacture of waterproof tissues, and in applying such waterproof material to woven fabrics and manufactured fibrous goods.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Dec.* 24, 1858.]

December 24*th.*

1442. S. Whitehall.
1447. E. Pinchon and W. R. Harris.
1448. E. E. d'Heurle.
1451. I. Hammond.
1460. B. Young and P. Brown.
1472. B. Nicoll.
1482. W. T. Smith.
1491. J. L. Clark.
1501. Oliver Sarony.
1512. J. Greenwood.
1542. M. Scott.
1556. J. B. Watson and V. B. Fadeuilhe.
1565. N. Defries.
1618. W. A. Lloyd and E. Edwards.
1822. M. Moses.
2083. J. Luis.
2368. E. C. Shepard.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, Dec.* 24, 1858.]

December 20*th.*

2893. C. J. Appleton.

December 21*st.*

2909. J. Chesterman.
2932. J. Grist.

[*From Gazette, Dec.* 28, 1857.]

December 23*rd.*

2917. R. A. Brooman.
2919. A. Tolhausen.
2931. J. E. Cook.
2934. J. Robinson, R. Cunliffe, and J. A. Collet.
2936. T. F. Uttley.
2950. T. Holmes.

December 24*th.*

2951. W. E. Newton.
9. W. Bullough.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4143	Dec. 27.	Portable Stereoscopic Camera	J. H. Powell	121, Newgate-street, E.C.
4144	,, 28.	Steam Pumping Engine	T. Cowburn	Manchester.

Journal of the Society of Arts.

FRIDAY, JANUARY 7, 1859.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

EXAMINATIONS, 1859.

The following Circular has been issued by the Central Committee of the Yorkshire Union of Mechanics' Institutes:—

Yorkshire Union of Mechanics' Institutes,
Central Committee, Mechanics' Institute, Leeds,
January 1, 1859.

Dear Sir,—We request you to call the attention of your Committee to the new terms on which the smaller Institutes in connection with the Yorkshire Union will be admitted to the Examination of the Society of Arts. A communication has just been received from the Secretary of the Society, in which he says—

"Having considered all the suggestions and returns which have been received from the Institutions, the Council concluded that the best mode of dealing with the subject at the present time would be to pass the following resolution, which was unanimously agreed to, viz.:—'That at the Examinations of 1859, the Provincial Unions in union with the Society of Arts may have the privilege of introducing Candidates belonging to smaller Institutes in union with such Provincial Union, but not in direct union with the Society of Arts, provided that a fee of two shillings and sixpence be paid to the Society of Arts by the Provincial Union in respect of each Candidate so admitted, and that the privilege be not exercised in favour of any Institute that has more than 50 members, or an annual income of more than £50.'"

We have to request your particular attention to the foregoing. Should you not be in union with the Society of Arts, nor in a position to take advantage of the concession made by the Council, we take the liberty to recommend your Committee to place your Institution in connection with the Society of Arts, in order that the benefits of the Examinations may be disseminated as widely as possible.

We also suggest that you should make the Examinations known as fully as possible to the members of your Institute, and, if practicable, organise classes for the preparation of Candidates for the special subjects named in the Programme of the Examinations of the Society of Arts.

We shall be happy to give you any further information that you may require, and are,

Dear Sir,
Yours truly,
JAMES HOLE, } Hon. Secs.
JAMES KITSON, Jun., }

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following gentlemen have been appointed the Local Board of Examiners for the Crosby Hall Evening Classes, London:—

Rev. Thomas Hugo.
Rev. J. W. Laughlin.
Rev. M. W. Lusignan.
Rev. Charles Mackenzie.
Mr. F. Reynolds.
Rev. R. Whittington.
Mr. Samuel Medley, *Secretary.*

The following gentlemen have been appointed the Local Board of Examiners for Selby:—

Mr. Thomas Cutting, Selby.
Mr. Henry Fisher, Selby.
Rev. S. H. Hooper, Parsonage, Drax.
Mr. George Lowther, Selby.
Rev. J. D. MacGachen, Selby.
Mr. Richard Taylor, Selby.
Mr. Thomas Werrey, Selby.
Mr. John Westwood, Selby, *Secretary*

BRITISH ASSOCIATION, LEEDS, 1858.

SHIPPING STATISTICS.

Woolwich Dockyard, 27th Dec. 1858.

Sir,—Misapprehension having arisen with reference to the exact purport and statistical detail of the report on "Shipping Statistics," which was publicly read by me in Section G, at the late meeting of the British Association at Leeds, in September, 1858, I beg to enclose herewith a copy of the report, in the hope that by its appearing in the pages of the Society of Arts Journal, the subject matter of the report may be correctly brought before the notice of gentlemen who are now taking an interest in the important question: "What is the best method of comparing the dynamic merits of steam ships?" I am, sir, your very obedient servant,

CHARLES ATHERTON.

P. Le Neve Foster, Esq.,
Sec. of the Society of Arts, London.

REPORT

From a Committee appointed by the British Association, to inquire into the statistics of shipping, with a view to rendering statistical record more available as data, conducive to the improvement of naval architecture as respects the adaptation of the form of ships to the requirements of sea service.

The Committee so appointed consisted of the following gentlemen:—

Admiral Moorsom.
J. Scott Russell.
J. E. McConnell.
Charles Atherton.
William Fairbairn.
James Perry.
Henry Wright.
Andrew Henderson.

The committee, on commencing their proceedings, received letters from Admiral Moorsom, Mr. John Scott Russell, and Mr. J. E. McConnell, whereby the Committee was deprived of the co-operation of those gentlemen as members of this Committee, the remaining members, however, agreed to prosecute the duties assigned to them, and William Fairbairn, Esq., F.R.S., by the unanimous desire of the Committee, undertook to conduct the proceedings as Chairman with the assistance of Henry Wright, Esq., as Honorary Secretary. The Committee now begs to explain the course of proceeding by which they hoped to promote, if not mature, the objects assigned to them by the Association.

In the first place, the Committee issued a circular, inviting statistical information as to the actual sea performances of ships (see Appendix), with a view to compiling a comprehensive statement, as to the sea performances of vessels generally, whence the Committee might be enabled to select a considerable number of vessels, of which the performances at sea may have been remarkable; and their attention being thus directed to a limited selection embracing a considerable number of vessels of practically established excellence for sea service, the Committee hoped, after making due inquiry, to be enabled to present, as respects those vessels, a statistical exposition, in tabular form, of their various elements of construction and type of build; and thus, by a system of collation and induction, to discover practically those types and elements of construction which have been found by experience most conducive to good performances at sea. In the case of steam-ships, it was purposed that the statistics of the original trials to which steamers are generally put when new, should also be collected, classified, and collated with reference to the subsequent performances of the same vessels at sea, whence it might be determined to what extent and in what respects the usual smooth-water trials of steam-ships may be indicative of the probable properties to be expected of the same ships at sea, as respects their dynamic capabilities.

The Committee are happy to say that this attempt at practically inquiring into the peculiarities of construction to which the good or bad qualities of steam-ships may be attributable, has not been wholly fruitless, for, although ship-owners, ship-builders, and marine engine manufacturers have been generally reluctant to communicate particulars whereby the dynamic merits of ships may be numerically classed and compared, the results of which classification and comparison might, if promulgated, affect the commercial value of their property, and the relative professional reputation of constructors, still, in reply to the before mentioned circular, information has been communicated, as to the performance of vessels, particularly steam-vessels, by which it appears that a great difference exists between steam-ships as respects their economic capabilities for the performance of mercantile steam transport service, leading to the conclusion that the general aggregate of steam service is performed by vessels of inferior adaptation for economic duty, and consequently at a rate of prime cost expenditure, and, therefore, ultimate charge on the public, greatly in excess of that which would be involved if all steamers were of the superior class of excellence that has been already, in certain cases, actually attained. For example: this Committee are assured, on authority which they believe to be unquestionable, that a certain vessel, the *Bremen*,* of 3440 tons displacement at the time of trial, propelled by engines working up to 1624 indicated horse-power, attained the speed of 13·15 nautical miles per hour. Now if we estimate the dynamic duty thus performed by the formula $\frac{V^3\ D^{\frac{2}{3}}}{\text{Ind. h.p.}} = C$, we shall have the co-efficient, $C = \frac{(13{\cdot}15)^3 \times (3440)^{\frac{2}{3}}}{1624} = \frac{2274 \times 227{\cdot}88}{1624} = 319$, and this co-efficient of dynamic duty, resulting from the mutual relation of displacement, speed, and power, appears, from the statements which have been communicated to this Committee, nearly 50 per cent. higher than that realized by the average performance of the steam-ships of the present day. The following are the co-efficients of dynamic duty deduced by the foregoing rule from the performances of mercantile steamers of high repute, of which the trial data have been communicated to this committee, viz., 325, 294, 291, 288, 259, 248, 231, 230, and 204, and many others below 200.

This Committee, therefore, regard the *Bremen* as being a felicitous exemplification of naval architecture as respects type of form adapted for easy propulsion; and as we conceive that the promulgation of some of the constructive elements of this vessel may be of public importance, we are happy in being authorised and enabled, by Messrs. Caird and Co., of Greenock, the constructors of the ship and of the engines, to communicate to the British Association the following statistical data as to the elements of construction of the *Bremen*:—

	Length between perpendiculars of stem and rudder post	318 feet.
	Breadth of beam	40 ,,
	Depth of hold	26 ,,
	Mean draught of water at the time of trial	18ft. 6in.
	Displacement (D) at trial draught	3440 tons.
	Area of maximum immersed section (A) at the trial draught	606 sq. ft.
	Distance of maximum section (A) measuring from the stem	159 feet.
	Constructors' load draught forw.	18 feet.
	Constructors' load draught aft.	19 ,,
	Displacement at constructors' load draught	3440 tons.
	Rate of ships' displacement at constructors' load draught	25 tons per inch.
Data for laying off Peake's curve of sections.	Area of immersed vertical section at the distance of $\frac{1}{8}$ length, measuring from stem	256·5 sq. ft.
	Do. $\frac{1}{4}$ Do. Do.	486 ,,
	Do. $\frac{1}{2}$ Do. Do.	606 ,,
	Do. $\frac{3}{4}$ Do. Do.	489 ,,
	Do. $\frac{7}{8}$ Do. Do.	253·5 ,,
Data for laying off curve of Displacement.	Displacement at draught of 4′ 7½″, being ¼ load draught	300 tons.
	Displacement at draught of 9′ 3″, being ½ load draught	1165 ,,
	Displacement at draught of 13′ 10½″, being ¾ load draught	2240 ,,
	Displacement at draught of 18′ 6″, or load draught	3440 ,,

The foregoing data afford all the particulars required for the construction of Peake's curve of vertical sections, whence may be deduced the position of the vertical line passing through the centre of gravity of displacement, and also the positions of the centre of gravity of the fore and aft bodies respectively.

It will be observed, from the foregoing data of the constructive elements of the *Bremen*, that the maximum immersed section is at the middle of the length, and that the vertical sections are in such ratio to each other, with reference to their respective positions, that the curve of vertical sections will be a close approximation to a parabola.

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* The *Bremen* is referred to as being the vessel which gave the highest co-efficient of dynamic performance of any vessel which was brought before the Committee, and of which the statistical data of construction were also given in a complete form.

The ratios deducible from the foregoing particulars of constructive data, combining Peake's curve of immersed vertical sections with the curve of displacement, will give a close approximation to the type of form of the immersed hull.

The engines of the *Bremen* consist of two direct-acting inverted cylinders, 90 inches diameter and 3 feet 6 ins. stroke, fitted with expansion valves capable of working expansively to a high degree. All parts of the engines are felted and lagged with wood wherever practicable, the lower 16 feet of the funnel being surrounded by a casing forming a superheating chamber, the steam entering at the lower end, and passing off at the top into the steam pipes leading to the cylinders.

On the important question as to the extent to which the ordinary smooth-water trial of a steamer affords a criterion of the general average performance that may be expected of the vessel at sea, this Committee has not been able to obtain such an extent of returns of the comparative smooth-water trials and sea performances of the same ships as enable them fully to respond to this part of the inquiry, and they refrain from expressing any speculative opinion, because they have adopted the principle which they desire to recommend to the notice of the British Association, that shipping improvement is to be discovered by statistical record and analysis of the constructive elements of ships that have practically shown themselves to possess good sea-properties, rather than by assuming the mere theories of opinionative speculation, from whatever source such opinions may emanate; in short, that experience of actual performances at sea, statistically recorded and utilized by being made the basis of comparison, is the most reliable base on which to construct an inductive system of progressive improvement in naval architecture and marine-engine construction. This Committee, however, have much satisfaction in being enabled to commence this inquiry by recording the sea performance of the before-mentioned vessel *Bremen*, on a passage from Bremen haven to New York and back, during the months of June and July last, during the whole of which passages indicator cards were frequently taken, and the indicated working power of the engines ascertained. On the out passage the mean displacement was 2,878 tons, the mean indicated horse-power was 1,078, and the mean speed 10·28 knots per hour, giving a co-efficient by the formula referred to = 204; but on the return passage the mean displacement was 2,990, the mean indicated horse-power 1,010, and the mean speed at the rate of 11·92 knots per hour, giving a co-efficient = 348. Hence, the mean co-efficient of the out and home passage = 276, being about 13 per cent. below the co-efficient (319) obtained on the smooth-water test-trial of the ship. The state of the weather and the sea was also recorded daily; it appears to have been adverse on the out passage, but favourable on the home passage. The Committee are, therefore, of opinion, that by following up this course of statistical record of the smooth-water trial and subsequent sea performances of ships respectively, a tabular statement might be compiled, showing the probable ratios of the co-efficients of smooth water and sea performance, corresponding to the various rates of speed for which steamers may be respectively powered, whence the smooth water test-trials of ships may be made available as approximately indicative of the sea service capabilities of ships as respects their dynamic properties.

Such are the statistical data of the constructive elements and dynamic capabilities of the *Bremen*, and if all steam-vessels engaged in the mercantile transport service of Britain were equally effective as respects the mutual relations of displacement, speed, and power, that is, capable of producing a co-efficient of dynamic capability = 319, by the formula referred to, it is probable that the prime cost expenses of steam-ship transport per ton weight of cargo conveyed on long passages would, on the aggregate of the foreign trade of Britain, be reduced not less than 25 per cent. as compared with the prime cost expenses incurred by steam-vessels of the average dynamic capability in present use.

The effect of improved type of build on the economy of steam transport per ton weight of goods conveyed, is such as shows the inquiry to be of vital importance in connection with the management of steam shipping affairs.

The public importance of improved type of build in a national point of view (for it is the public and not the shipowners who ultimately bear the brunt of expensive transport service), may be judged of from the statistical fact published by the Board of Trade, that no less than 899 steam-vessels (of which 511 are sea-going ships) were employed on the commercial transport service of Britain in 1857. The ratio in which the transport service of the country is performed by the aid of steam appears to be constantly on the increase, and as it is to be expected that mercantile competition will always cause the cost of freight on the general aggregate of the trade of the country to be proportionally ruled by the prime cost expenses that may be actually incurred in doing the work, it appears manifest that the public economy dependent on the general realization of shipping improvement, is a consideration that involves public interest to the extent of millions sterling per annum.

To demonstrate the vast importance of this subject, the tables in the Appendix have been compiled from the returns of the Board of Trade, to show the amount of trade between the United Kingdom and foreign countries during the year 1855. This compilation shows that the tons weight of cargo actually carried in the foreign trade of the United Kingdom in the year 1855 amounted to—

Imports	6,254,259 tons.
Exports	8,370,363 ,,
Total	14,624,622 ,,

Nearly 15 millions of tons weight of sea-borne cargo conveyed at probably 25 per cent. extra cost beyond what would be incurred if ships of the high order of dynamic merit exemplified by the *Bremen* were only and exclusively employed.

By aid of the Appendix, showing the amount of trade between Great Britain and all foreign countries respectively, parties conversant with shipping affairs will be enabled to estimate approximately the gross amount annually involved in the goods transport service of Britain. Thus public interests require that the statistical records of shipping should embrace such data as will be availably conducive to shipping improvement, by affording the means of approximately estimating the dynamic capabilities of ships, whereby every ship-constructor and ship-owner, and the directors of steam shipping companies, may be enabled to test the dynamic merits and condition of their ships respectively, a system which would gradually lead to the adoption of such types only as develop a high order of dynamic duty, and would obviate some of the most serious hazards to which private and public interests are now exposed from vessels being employed on commercial and postal services for which they are not fit.

Only let it be publicly known, as exemplified by the *Bremen*, that steam ships and their machinery may be so constructed, that on being subjected to a test-trial, the cube of the speed in knots, multiplied by the square of the cube root of the displacement, and divided by the indicated horse-power, ought, in the present day, irrespective of future improvement, to produce a quotient or co-efficient of dynamic duty equal to the number 319, and that the co-efficient deduced from the rule thus enunciated constitutes (*cœteris paribus*) a criterion of the cost price at which steam ships perform their work, and we shall then soon find that this test of dynamic merit, or the numeral co-efficient deduced therefrom, will enter into the calculation of the pecuniary value of steamers to such an extent, that ships of a low order of dynamic capability will not be built because they will not sell.

The test of dynamic merit, as above set forth, based on the mutual relations of displacement, speed, and power, presumes on the net power effectively applied in propelling the ship being always in a constant and known ratio to the gross indicated power.

The inquiry, therefore, so far, is of such a nature as demands professional knowledge and skill in order to determine and discriminate between the merit that may be due respectively to the type of form of the hull, and to the construction of the engines, propeller, and boilers; for a good type of hull, propelled by an inferior construction of machinery and boilers, or an inferior type of hull propelled by a good construction of machinery and boilers may, by the above formula, produce equal results. This Committee, however, considers it of vital importance to the promotion of the objects of this inquiry, viz., "the maturing of a system of statistical record conducive to the improvement of naval architecture," that the owners and charterers of ships, and the directors of shipping companies or agents by whom shipping affairs are conducted, should themselves have the means of ascertaining the relative dynamic merits and working condition of their ships without any reference whatever to the professional assistance of builders or engineers, but be enabled to judge for themselves whether the performance be good or bad by reference to the data afforded by their counting-house records; and this desirable object may be at once effected by the displacement of the ship being known, and by substituting in the foregoing formula the consumption of fuel in a given time (say the weight in cwts. (W) consumed per hour), in lieu of the expression for power, and regarding the hull, machinery, and boilers collectively as an integral equipment of which the co-efficient derived from the formula $\frac{V^3 \times D^{\frac{2}{3}}}{W}$ indicates the dynamic condition with reference to the dynamic condition of other vessels tested by the same rule, viz., multiply the cube of the speed by the square of the cube root of the mean displacement, and divide the product by the consumption of fuel per hour expressed in cwts. The quotient indicates the relative dynamic condition of the vessel. For example: A steam-ship (A) performed out and home voyages amounting to 7,200 nautical miles in 652 hours, being at the average speed of 11·04 knots per hour, the consumption of coal was 1,519 tons or 30,380 cwts., being at the rate of 47 cwts. per hour, and the mean displacement was 2,934 tons. Hence the co-efficient of dynamic duty indicative of the merits of the performance on this occasion is—

$$\frac{(11{\cdot}04)^3 \times (2934)^{\frac{2}{3}}}{47} = \frac{1345{\cdot}6 \times 205}{47} = 5870.$$

Again, another vessel (B), with a mean displacement of 840 tons, attains on long-continued service the average speed of 12·78 knots per hour, with the average consumption of 50·3 cwts. coal per hour, giving a co-efficient of dynamic duty $\frac{(12{\cdot}78)^3 \times (840)^{\frac{2}{3}}}{50{\cdot}3} = \frac{2087{\cdot}3 \times 89}{50{\cdot}3} = 3693.$ Thus, in one case (A) the co-efficient of dynamic duty, based on the consumption of fuel, is 5870, whilst in the other case (B) it is only 3693; that is, one cwt. of coal in A performs as much dynamically effective work as is performed by $1\frac{6}{10}$ cwts. in the case of B, a discrepancy which may well induce professional inquiry being instituted by the shipowner, whether the inferior performance of B is occasioned by inferior type of form, or foulness of bottom, or inferior principle of mechanical appliances, or inferior management, or bad coal; for these causes combined, or indeed either one of them alone, may be sufficient to account for the result.

Now, what are the all-important elements of construction thus proposed to be embraced in public records, and thereby made known to the purchasers and charterers of ships with a view to enable such parties to test the economic working capabilities of ships, so conducive to the reformation above referred to? Why, by the rule above enunciated, the displacement corresponding to the constructor's load draught at which the ship may be tried, and to which approximately, as a general rule, the ship may be loaded, becomes the only item of statistical data that requires to be officially recorded, for the test trial and sea performances of ships, as above shown will give the capabilities for speed; and the consumption of fuel per hour corresponding thereto will be known from the counting-house ledger.

It is, therefore, suggested that the registration records of every ship give the displacement when the ship is immersed down to some definite line, which may be denominated the constructor's load line.

The assignment of the constructor's load line draught forward and aft, and the corresponding displacement, are all the statistical data that are required to be registered in addition to the details of registration already enforced under the Merchant Shipping Act of 1854, in order to determine the comparative co-efficients, and put the system of practical rivalry hereby suggested into operation, as being the most effective system for inducing improvement in naval architecture.

As regards the existing system of shipping statistics and shipping registration, with reference to its affording data available for promoting shipping improvement, this Committee has to observe that, although the aggregate register tonnage of mercantile shipping appears to be a very close approximation to the aggregate weight-carrying capability of the entire mercantile navy, still, when considered in detail with reference to particular ships, it is found that the register tonnage of a ship affords no approximate criterion whatever either of the load displacement or of the weight-carrying capabilities of ships respectively, for, by reference to the Appendix, it will be found that ships are frequently loaded with dead weight of cargo to the extent of double their register tonnage, and the statement given below shows the following extreme cases of weight-carrying capability with reference to register tonnage:—

Country traded with.	Vessels.	Weight of Cargo.	Register Tonnage.	Ratio of Cargo to Tonnage.
		Tons.		
Morocco	34	11,576	4,075	2·8 to 1
Tunis	1	780	259	3 to 1
Bolivia	2	2,391	455	5·2 to 1

These cases appeared so remarkable that the Committee were anxious to prosecute inquiries with reference to the build and sea performances of those particular ships, and with that view they addressed a letter to the Custom House for the purpose of identifying the vessels thus referred to; but the official fees demanded for responding to such inquiries, put it out of the power of the Committee to avail themselves to any useful purpose of the shipping statistics of Government.

Another difficulty which greatly obstructs the collecting of statistics on the sea performances of mercantile shipping, is the great number of vessels bearing the same name. In many cases, there are scores of vessels bearing the same name, thus rendering it extremely difficult to trace and scrutinize the performance of a vessel of any name with certainty as to her identity; for, in publishing the arrivals and departures of shipping in mercantile navy records, the registered number of a ship, which constitutes the only means of identification, is not generally given in connection with her name.

A further instance of the insufficiency of our present system of shipping registration as statistical data indicative of the size of the hull of steam shipping, is afforded by the statement given in the Appendix, which has been deduced from a Return of the House of Commons, showing the per centage deduction from the gross tonnage allowed for the engine rooms of steamships, whence we see that, without any reference whatever being made to the actual weight of the machinery, deductions are made from the gross tonnage varying from 5 per cent. to 92 per cent. of the gross measurement, the remainder only being brought to account as the registered tonnage of the ship.

In conclusion, this Committee begs to observe, that if the views thus brought before the notice of the British Association should be deemed worthy of further prosecution, and be favourably entertained by the Government, the statistics of the Post-office, as respects the constructive elements, and test-trials, and subsequent sea performances of the various steam-ships employed in H.M. Mail Service, would afford a collection of statistical data which, if duly analysed and applied as herein suggested, would greatly promote the objects of this inquiry which the British Association has thus been pleased to institute.

The Committee has the painful duty of announcing the death of one of its members, James Perry, Esq., whose personal character, practical intelligence, and public usefulness, were of such an order, that his decease may be mourned as a public loss.

(Signed)
WILLIAM FAIRBAIRN, Chairman.
CHARLES ATHERTON.
ANDREW HENDERSON.
HENRY WRIGHT.

APPENDIX.

TO SHIPPING COMPANIES, SHIPOWNERS, AND OTHERS CONNECTED WITH THE MERCANTILE MANAGEMENT AND DIRECTION OF SHIPS.

COMMITTEE ON SHIPPING STATISTICS.

11, Buckingham-street, Adelphi, London, W.C.,
26th April, 1858.

GENTLEMEN,—The attention of the British Association at their late meeting in Dublin having been directed to the consideration of shipping statistics, the Committee of the Association came to the resolution "that the application of science to the improvement of steam-ships has been impeded by the difficulty of obtaining the necessary data from the present registration;" a Committee was thereupon appointed to inquire into this subject, which Committee beg the favour of your assistance, with a view to ascertain, from the general experience and records of shipping companies, shipowners, and others connected with the mercantile management and direction of shipping, what description of vessels has produced the best results.

In the prosecution of this inquiry, the Committee desire now, in the first place, to ascertain what have been the actual sea performances of ships, and their attention being thus directed to instances in which the performance of particular ships has been remarkable, further steps will hereafter be taken to inquire into the circumstances of such cases, and ascertain the peculiarities of proportion and type of form of the vessels which have produced such results.

With these objects in view, the Committee request the favour of your filling up the annexed form, giving an example of the quickest voyage made by each of the vessels of the line of packets under your direction, on the passage or station on which such vessels respectively may have been employed.

I am, Gentlemen,
Your very obedient servant,
HENRY WRIGHT, Hon. Sec.
By Order of the Committee.

N.B.—The Committee will feel obliged by your returning the form, when filled up, to the above address, as soon as convenient, not later than 1st of June.

SHIPPING COMMITTEE.
OFFICE—11, BUCKINGHAM-STREET, LONDON, W.C. } *It is requested that this* FORM *be filled up and returned by the* 1*st of June*, 1858.

Name of Vessel and Registered Number.	Description of Vessel; whether Steamer or Sailing Vessel, and her Rig.	Passage referred to as an example of the performance of the Ship.			Load Draught.	Length of Vessel, as usually measured for Builders' Tonnage.	Outside Breadth of Vessel, as measured for Builders' Tonnage.	Depth of Hold.	Builders' Tonnage.	Register Tonnage.	Registered H.P.	Coals consumed on voyage, if a Steamer.	NOTE.—In addition to the foregoing particulars, it is requested that the Displacement of the Vessels be given at the following Draughts, if known.					
													When Launched.		When ready for Cargo.		When immersed to Constructor's Load-line.	
		Port of Departure, and Date of Departure.	Port of Arrival, and Date of Arrival.	Detention on voyage by stoppage at intermediate Ports, or Becalmed.									Draught.	Displacement.	Draught.	Displacement.	Draught.	Displacement.
				Dys. Hrs.	Ft. In.	Ft. In.	Ft. In.	Ft. In.				Tns. Cwts.	Ft. In.	Tons.	Ft. In.	Tons.	Ft. In.	Tons.

*Signature*____________________

*Address*____________________

APPENDIX.

Table showing the difference which exists between the "Register Tonnage" of Vessels and the "Tons Weight" of Cargo actually carried in the Trade and Navigation of the United Kingdom with Foreign Countries and British Possessions in 1852, '53, '54, and '55, deduced from Returns of the Board of Trade.

		IMPORTS.					EXPORTS.				
Name of Country.	Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.
NORTHERN RUSSIA	1852	2022	410,875	452,291	+ 41,416	+10	1690	343,459	280,856	− 62,603	−18
	1853	3006	581,713	709,390	+127,677	+22	2291	458,811	314,930	−143,881	−31
	1854	434	72,772	89,174	+ 16,898	+23	243	36,947	2,735	− 34,212	−92
	1855	...	...	1,174	...	...	...	...	...	...	...
SOUTHERN RUSSIA	1852	599	184,020	161,206	− 22,814	−12	117	35,280	21,788	− 13,492	−38
	1853	692	207,305	185,593	− 21,712	−10	174	50,261	14,810	− 35,451	−75
	1854	422	121,761	111,074	− 10,687	− 8	32	10,200	4,486	− 5,714	−56
	1855	...	...	22,143	...	...	...	...	...	...	...
CRIMEA	1855	80	27,906	905	− 27,001	−96	358	146,377	56,230	− 90,147	−61*
SWEDEN	1852	1013	195,819	308,355	+112,536	+57	781	142,981	82,928	− 60,053	−42
	1853	1352	256,579	399,836	+143,257	+51	1087	187,905	90,630	− 97,275	−51
	1854	1530	278,489	440,940	+162,451	+58	1113	194,296	113,199	− 81,097	−41
	1855	1551	316,568	467,160	+140,592	+44	1052	194,870	127,919	− 66,951	−34
NORWAY	1852	1391	216,027	218,524	+ 2,497	+ 1	1435	232,601	70,598	−162,003	−69
	1853	1888	301,717	313,158	+ 11,441	+ 3	1991	315,990	80,288	−235,702	−74
	1854	1917	299,197	314,717	+ 15,520	+ 5	2201	352,466	104,334	−248,132	−70
	1855	1585	285,402	240,124	− 45,278	−15	1676	273,857	118,206	−155,651	−56
DENMARK	1852	2112	195,198	183,588	− 11,610	− 5	1305	464,131	401,578	− 62,553	−13
	1853	2324	214,742	232,301	+ 17,559	+ 8	5477	619,433	411,312	−208,121	−33
	1854	2286	202,462	223,402	+ 20,940	+10	5364	617,384	495,858	−121,526	−19
	1855	2373	229,753	247,792	+ 18,039	+ 7	4680	545,478	512,702	− 22,776	− 4
PRUSSIA	1852	1972	299,493	409,504	+110,011	+36	1833	298,814	334,465	+ 35,651	+11
	1853	3542	573,687	776,656	+202,969	+35	2535	441,379	399,223	− 42,156	− 9
	1854	3145	540,130	682,654	+142,524	+26	2425	437,724	446,529	+ 8,805	+ 2
	1855	2907	544,268	640,960	+ 96,692	+17	2441	451,779	521,422	+ 69,643	+15
MECKLENBURG	1852	234	25,207	29,629	+ 4,422	+17	132	18,778	19,062	+ 284	+ 1
	1853	266	32,869	34,536	+ 1,667	+ 5	188	29,106	32,742	+ 3,636	+12
	1854	210	27,569	27,854	+ 285	+ 1	149	21,784	23,381	+ 1,597	+ 7
	1855	203	27,693	36,569	+ 8,876	+32	176	27,763	37,487	+ 9,724	+35
HANOVER	1852	767	51,180	31,375	− 19,805	−38	691	47,936	62,193	+ 14,257	+29
	1853	644	42,599	35,415	− 7,184	−16	707	52,248	65,867	+ 13,619	+26
	1854	669	45,003	37,636	− 7,367	−16	774	54,601	64,722	+ 10,121	+18
	1855	742	58,000	36,753	− 21,247	−36	851	64,681	87,936	+ 23,255	+36
OLDENBURG	1852	223	13,261	8,737	− 4,524	−34	172	9,638	14,486	+ 4,848	+50
	1853	153	10,196	5,183	− 5,013	−49	133	9,545	12,141	+ 2,596	+27
	1854	144	9,568	9,211	− 357	− 3	129	9,073	11,601	+ 2,528	+27
	1855	202	19,732	10,684	− 9,048	−45	154	14,437	19,186	+ 4,749	+32
HANSE TOWNS	1852	2494	502,819	79,592	−423,227	−84	2736	513,814	493,096	− 20,718	− 4
	1853	2401	475,335	115,729	−359,606	−75	2636	489,934	484,233	− 5,701	− 1
	1854	2493	519,720	165,007	−354,713	−68	2719	543,989	502,330	− 41,659	− 7
	1855	2810	627,127	125,279	−501,848	−80	2815	563,686	607,497	+ 43,811	+ 7
HOLLAND	1852	3454	617,152	141,681	−475,471	−77	2669	417,052	321,758	− 95,294	−24
	1853	3113	644,091	147,552	−496,539	−77	2315	380,306	283,222	− 97,084	−25
	1854	3298	621,322	190,789	−430,533	−69	2749	440,659	364,419	− 76,240	−17
	1855	4127	717,955	155,634	−562,321	−78	2950	503,156	434,240	− 68,916	−13
JAVA AND SUMATRA	1852	10	4,218	4,610	+ 392	+ 9	43	19,914	14,873	− 5,041	−25
	1853	12	4,969	6,483	+ 1,514	+30	36	18,699	15,576	− 3,123	−16
	1854	24	10,436	11,467	+ 1,031	+ 9	34	15,494	11,417	− 4,077	−26
	1855	10	5,163	7,957	+ 2,794	+54	42	20,301	12,674	− 7,627	−37

* Not including Transports and munitions of war.

APPENDIX (Continued.)

	IMPORTS.						EXPORTS.				
Name of Country.	Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo with reference to Tonnage.	Per Centage of Difference.
BELGIUM	1852	1265	222,375	40,319	−182,056	−81	920	154,810	98,333	− 56,477	−36
	1853	1241	226,156	44,177	−181,079	−80	882	155,536	112,680	− 42,906	−27
	1854	1338	236,508	77,632	−158,976	−67	912	169,996	130,891	− 39,105	−23
	1855	1544	274,031	51,826	−222,205	−81	1084	179,692	112,955	− 66,737	−37
FRANCE	1852	7867	851,128	232,969	−618,159	−75	7478	838,628	719,283	−119,345	−14
	1853	8884	1,014,334	249,541	−764,793	−75	8218	920,783	812,468	−108,315	−11
	1854	8728	1,018,298	147,632	−870,666	−85	8185	989,093	931,930	− 57,163	− 5
	1855	9776	1,250,343	135,298	−1115045	−89	9569	1,172,065	1,211,385	+ 39,320	+ 3
ALGERIA	1852	7	779	1,194	+ 415	+53	76	13,905	16,939	+ 3,034	+21
	1853	29	3,723	6,276	+ 2,553	+68	112	19,374	26,298	+ 6,924	+35
	1854	38	6,065	9,403	+ 3,338	+55	194	25,527	24,190	− 1,337	− 5
	1855	19	3,645	1,695	− 1,950	−53	140	23,224	30,592	+ 7,368	+31
ISLE OF BOURBON	1852	...	...	...	...	...	...	...	...	...	...
	1853	...	...	...	...	...	...	...	...	...	...
	1854	1	220	230	+ 10	+ 4	2	632	657	+ 25	+ 4
	1855	...	...	...	...	...	5	1,398	154	− 1,244	−88
PORTUGAL, AZORES, MADEIRA	1852	838	82,371	68,728	− 13,643	−16	1029	127,767	73,584	− 54,183	−41
	1853	815	94,886	95,127	+ 241	+ 2	1197	171,299	126,631	− 44,668	−26
	1854	1023	116,842	120,501	+ 3,659	+ 3	1046	150,527	103,522	− 47,005	−31
	1855	886	110,211	118,822	+ 8,611	+ 7	920	127,988	104,029	− 23,959	−18
CAPE VERD ISLANDS	1852	3	496	678	+ 182	+36	56	12,871	8,886	− 3,985	−30
	1853	2	278	411	+ 133	+47	58	14,222	16,802	+ 2,580	+18
	1854	3	464	677	+ 213	+43	63	14,175	14,503	+ 328	+ 2
	1855	1	139	195	+ 56	+40	35	8,607	10,321	+ 1,714	+19
SPAIN AND CANARIES	1852	655	75,342	54,497	− 20,845	−27	1445	263,516	250,087	− 13,429	− 5
	1853	781	90,561	80,469	− 10,092	−11	1709	294,001	294,087	+ 86	+·03
	1854	1047	125,443	105.113	− 20,330	−16	1663	259,961	265,850	+ 5,889	+ 2
	1855	1372	179,030	150,837	− 28,193	−15	1387	239,519	239,491	− 28	−·01
CUBA AND PORTO RICO	1852	199	60,363	57,284	− 3,079	− 5	245	70,768	63,680	− 7,088	−10
	1853	329	87,398	95,557	+ 8,159	+ 9	297	85,161	81,717	− 3,444	− 4
	1854	488	144,393	162,313	+ 17,920	+12	297	84,575	76,023	− 8,552	−10
	1855	317	100,137	110,772	+ 10,635	+10	380	119,885	116,003	− 3,882	− 3
PHILLIPPINE ISLANDS	1852	9	4,823	6,079	+ 1,256	+26	10	5,178	6,833	+ 1,655	+31
	1853	6	3,324	3,719	+ 395	+11	15	7,024	9,100	+ 2,076	+29
	1854	27	14,267	21,692	+ 7,425	+52	9	4,797	4,217	− 580	−12
	1855	31	17,785	22,158	+ 4,373	+24	11	5,873	4,562	− 1,311	−22
FERNANDO PO	1852	...	...	2,010	...	...	...	...	6,968	...	...
	1853	...	...	5,488	...	...	...	...	9,502	...	...
	1854	14	6,820	5,230	− 1,590	−23	20	7,614	5,073	− 2,541	−33
	1855	16	6,824	6,679	− 145	− 2	17	6,759	5,234	− 1,525	−22
SARDINIA	1852	53	14,068	2,181	− 11,887	−84	303	65,186	73,477	+ 8,291	+12
	1853	51	15,863	2,501	− 13,362	−84	437	96,399	112,246	+ 15,847	+16
	1854	180	48,528	3,497	− 45,031	−92	467	102,491	118,429	+ 15,938	+15
	1855	105	32,085	11,157	− 20,928	−65	320	97,027	112,352	+ 15,325	+15
TUSCANY	1852	110	18,483	17,706	− 777	− 4	99	19,260	23,592	+ 4,332	+22
	1853	139	24,776	25,645	+ 869	+ 3	124	21,695	28,154	+ 6,459	+29
	1854	172	30,672	26,141	− 4,531	−14	119	19,881	25,074	+ 5,193	+26
	1855	206	37,897	28,805	− 9,092	−24	87	13,676	20,687	+ 7,011	+51
PAPAL STATES	1852	43	8,157	7,383	− 774	− 9	49	8,292	9,782	+ 1,490	+18
	1853	45	7,726	10,419	+ 2,693	+34	53	9,587	11,229	+ 1,642	+17
	1854	20	3,674	2,004	− 1,670	−45	37	6,542	8,085	+ 1,543	+23
	1855	27	5,102	6,760	+ 1,658	+32	39	6,758	11,080	+ 4,322	+64
NAPLES	1852	404	54,985	69,575	+ 14,590	+26	371	64,327	70,370	+ 6,403	+ 9
	1853	371	55,079	72,822	+ 17,743	+32	359	64,695	72,326	+ 7,631	+11
	1854	509	81,729	104,809	+ 23,080	+28	360	63,181	72,531	+ 9,350	+14
	1855	411	71,987	82,006	+ 10,019	+13	404	73,422	93,194	+ 19,772	+27
AUSTRIA	1852	117	28,900	28,439	− 461	− 1	357	95,529	97,744	+ 2,215	+ 2
	1853	147	34,070	30,238	3,832	−11	344	83,463	86,115	+ 2,652	+ 3
	1854	178	48,396	28,774	− 19,622	−40	308	76,034	94,127	+ 18,093	+23
	1855	164	45,126	42,495	− 2,631	− 5	193	65,877	78,813	+ 12,936	+19
GREECE	1852	53	7,470	6,707	− 763	−10	78	17,021	10,014	− 7,007	−41
	1853	91	15,120	11,368	− 3,752	−24	86	21,425	12,263	− 9,162	−42
	1854	58	9,361	7,055	− 2,306	−24	101	22,679	29,605	+ 6,926	+30
	1855	178	39,919	41,901	+ 1,982	+ 4	78	22,716	34,658	+ 11,942	+52
TURKEY	1852	335	76,098	73,816	− 2,282	− 3	566	146,976	94,825	− 52,151	−35
	1853	600	155,973	184,952	+ 28,979	+18	876	237,860	102,836	−135,024	−56
	1854	429	123,444	104,893	− 18,551	−15	1038	356,558	301,580	− 44,978	−12
	1855	439	131,336	84,453	− 46,883	−35	1718	559,295	541,417	− 17,878	−

APPENDIX (CONTINUED.)

		IMPORTS.					EXPORTS.				
Name of Country.	Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.
WALLACHIA AND MOLDAVIA	1852	565	105,942	143,385	+ 37,443	+35	157	25,669	14,878	— 10,791	—42
	1853	557	97,706	133,849	+ 36,143	+37	123	19,047	8,301	— 10,746	—56
	1354	142	21,715	29,872	+ 8,157	+37	6	666	1,017	+ 351	+52
	1855	11	2,683	4,642	+ 1,959	+73	5	606	590	— 16	— 2
SYRIA AND PALESTINE	1852	27	5,408	5,599	+ 191	+ 3	71	14,600	8,038	— 6,562	—45
	1853	45	9,491	11,223	+ 1,732	+18	51	10,997	9,730	— 1,267	—11
	1854	21	4,693	4,896	+ 203	+ 4	42	9,601	9,226	— 375	— 3
	1355	24	5,445	3,119	— 2,326	—42	90	20,046	16,726	— 3,320	—16
EGYPT	1852	557	174,400	179,860	+ 5,460	+ 3	257	79,359	63,679	— 15,680	—19
	1853	451	152,936	156,694	+ 3,758	+ 2	170	71,237	31,412	— 39,825	—55
	1854	400	133,053	141,458	+ 8,405	+ 6	258	94,208	77,868	— 16,340	—17
	1855	468	153,418	175,043	+ 21,625	+14	191	72,196	58,057	— 14,139	—19
TRIPOLI	1852	...	...	...	...	...	...	...	...	...	...
	1853	...	...	...	...	...	...	...	...	...	...
	1854	...	...	13	...	...	...	...	...	...	...
	1855	...	...	127	...	...	...	...	...	...	...
TUNIS	1852	...	...	100	...	...	1	259	780	+ 521	+201*
	1853	...	...	106	...	...	4	728	858	+ 130	+17
	1854	1	164	226	+ 62	+37	9	1,542	1,938	+ 396	+24
	1855	2	224	...	...	...	9	1,492	2,269	+ 777	+52
MOROCCO	1852	39	4,357	3,349	— 1,008	—23	25	3,375	1,716	— 1,659	—49
	1853	76	8,448	8,300	— 148	— 1	37	5,511	1,770	— 3,741	—67
	1854	110	12,720	14,664	+ 1,944	+15	34	4,075	11,576	+ 7,501	+184
	1855	142	16,720	19,827	+ 3,107	+19	45	5,719	4,244	— 1,475	—25
UNITED STATES	1852	1382	1,101,023	728,441	—372,582	—33	2026	1,442,076	1,193,216	—248,860	—17
	1853	1436	1,088,009	797,747	—290,262	—26	2157	1,541,278	1,347,918	—193,360	—12
	1854	1502	1,291,532	956,516	—335,016	—26	1972	1,486,551	1,225,867	—260,684	—17
	1855	1171	1,096,379	604,554	—491,825	—45	1498	1,334,237	1,021,418	—312,819	—23
MEXICO	1852	21	13,781	6,335	— 7,446	—54	43	16,787	14,039	— 2,748	—16
	1853	24	7,406	9,438	+ 2,032	+27	50	12,724	9,821	— 2,903	—22
	1854	21	6,360	9,854	+ 3,494	+54	33	7,041	6,521	— 520	— 7
	1855	38	8,101	9,582	+ 1,481	+18	47	10,656	8,710	— 1,946	—18
CENTRAL AMERICA	1852	50	15,354	5,772	— 9,582	—62	26	9,300	2,418	— 6,882	—74
	1853	34	7,136	4,213	— 2,923	—40	13	3,075	1,938	— 2,137	—69
	1854	46	9,690	2,540	— 7,150	—73	10	4,012	1,611	— 2,401	—59
	1855	19	5,005	2,452	— 2,553	—51	17	5,342	2,586	— 2,756	—57
HAYTI	1852	55	11,537	12,583	+ 1,046	+ 9	45	7,988	2,951	— 5,037	—63
	1853	47	10,630	12,226	+ 1,596	+15	29	4,455	1,592	— 2,863	—54
	1854	45	9,405	10,188	+ 783	+ 8	40	7,201	2,331	— 4,870	—66
	1855	31	7,163	7,654	+ 491	+ 6	30	4,987	1,493	— 3,494	—70
FOREIGN WEST INDIES	1852	5	996	434	— 562	—56	209	65,878	55,037	— 10,841	—16
	1853	39	44,899	796	— 44,103	—98	246	101,916	71,631	— 30,285	—29
	1854	53	48,754	2,773	— 46,021	—94	249	95,217	57,961	— 37,256	—39
	1855	53	50,775	3,583	— 47,192	—92	231	96,517	56,859	— 39,658	—41
NEW GRANADA	1852	39	8,018	6,134	— 1,884	—23	80	48,105	36,742	— 11,363	—24
	1853	27	5,973	4,716	— 1,257	—21	39	13,100	17,073	+ 3,973	+30
	1854	40	9,094	9,314	+ 220	+ 2	21	6,526	6,099	— 427	— 6
	1855	42	9,614	8,979	— 635	— 6	27	6,636	6,789	+ 153	+ 2
VENEZUELA	1852	8	1,429	1,022	— 407	—28	32	5,997	3,213	— 2,784	—46
	1853	9	1,626	1,219	— 407	—25	27	5,106	2,710	— 2,396	—46
	1854	13	2,676	2,240	— 436	—16	39	6,885	3,292	— 3,592	—52
	1855	11	2,747	3,432	+ 685	+25	35	6,250	3,697	— 2,553	—40
BRAZIL	1852	247	71,578	43,623	— 27,955	—39	435	115,024	102,104	— 12,920	—11
	1823	318	88,455	63,865	— 24,590	—27	422	122,493	105,005	— 17,488	—14
	1854	273	86,077	61,858	— 24,219	—28	539	161,373	157,408	— 3,965	— 2
	1855	305	85,037	62,450	— 22,587	—26	446	144,483	127,125	— 17,358	—12
MONTE VIDEO	1852	34	6,977	7,005	+ 28	+ ·4	42	8,687	11,023	+ 2,336	+26
	1853	57	12,288	12,653	+ 365	+ 3	30	9,603	14,058	+ 4,455	+46
	1854	40	9,091	10,232	+ 1,141	+12	46	12,376	12,885	+ 509	+ 4
	1855	69	14,816	17,228	+ 2,412	+16	34	9,723	14,897	+ 5,174	+53
BUENOS AYRES	1852	124	28,047	30,033	+ 1,986	+ 7	92	20,043	15,145	— 4,898	—24
	1853	97	21,230	31,330	+ 100	+ ·4	67	14,890	8,705	— 6,185	—41
	1854	122	26,967	30,224	+ 3,257	+12	117	26,802	24,270	— 2,532	— 9
	1855	112	25,182	25,568	+ 386	+ 1	88	22,544	17,523	— 5,021	—22
PATAGONIA	1852	23	5,455	7,282	+ 1,827	+33	...	...	...	...	...
	1853	6	1,758	2,245	+ 487	+27	...	...	...	...	...
	1844	1	368	431	+ 63	+17	...	...	...	...	...
	1855	2	558	...	...	...	...	...	...	...	...

* *Queen of the Tyne*, sailing vessel. Registered Number, 3443.

APPENDIX (CONTINUED.)

		IMPORTS.					EXPORTS.				
Name of Country.	Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.
CHILI	1852	74	22,750	23,378	+ 620	+ 2	142	55,545	51,253	− 4,292	− 7
	1853	95	30,974	30,057	− 917	− 3	138	57,953	59,267	+ 1,314	+ 2
	1854	83	27,985	34,509	+ 6,524	+ 23	191	64,846	66,925	+ 2,079	+ 3
	1855	99	31,851	41,332	+ 9,481	+ 29	135	60,434	60,919	+ 485	+ ·8
BOLIVIA	1852	12	4,664	6,519	+ 1,855	+ 39	2	280	...	...	...
	1853	1	736	1,659	+ 923	+125*	1	199	...	...	...
	1854	...	...	834	...	...	...	...	...	...	...
	1855	2	455	2,391	+ 1,936	+425†	...	...	...	...	...
PERU	1852	166	78,384	102,236	+ 23,852	+ 30	69	34,679	35,142	+ 463	+ 1
	1853	210	103,873	125,899	+ 22,026	+ 21	71	29,062	23,313	− 5,749	− 19
	1854	378	191,044	243,934	+ 52,890	+ 27	104	60,898	32,717	− 28,181	− 46
	1855	371	219,215	274,199	+ 54,984	+ 25	89	47,410	32,300	− 15,110	− 31
ECUADOR	1852	...	...	138	...	...	2	849	47	− 802	− 94
	1853	2	565	270	− 295	52	5	1,325	373	− 952	− 71
	1854	2	464	573	+ 109	23	2	509	161	− 348	− 68
	1855	2	720	907	+ 187	26	1	261	184	− 77	− 29
CHINA (including HONG KONG)	1852	118	63,997	33,592	− 30,405	− 47	99	47,097	37,929	− 9,168	− 19
	1853	118	64,928	33,289	− 31,639	− 48	114	56,028	50,283	− 5,745	− 12
	1854	135	79,084	40,952	− 38,132	− 48	64	34,814	28,536	− 6,278	− 18
	1855	133	83,211	40,785	− 42,426	− 50	96	53,929	45,506	− 8,423	− 15
BORNEO AND INDIAN ARCHIPELAGO	1852	...	...	...	...	...	1	532	743	+ 211	+ 39
	1853	...	...	...	...	...	3	1,722	3,241	+ 1,519	+ 88
	1854	...	...	...	...	...	...	...	...	...	...
	1855	...	...	...	...	...	...	...	...	...	...
BIRMAN EMPIRE	1852	...	...	...	...	...	...	...	...	...	...
	1853	...	...	...	...	...	5	2,675	1,871	− 804	− 30
	1854	...	...	434	...	...	9	3,561	27	− 3,534	− 99
	1855	...	...	...	...	...	8	3,125	23	− 3,102	− 99
PERSIAN GULF	1852	...	...	...	...	...	1	162	...	...	...
	1853	...	...	...	...	...	2	337	209	− 128	− 35
	1854	...	...	...	...	...	...	...	...	...	...
	1855	...	...	...	...	...	...	...	...	...	...
RED SEA	1852	...	...	...	...	...	5	2,312	2,466	+ 154	+ 6
	1853	...	...	...	...	...	4	1,115	766	− 349	− 31
	1854	...	...	...	...	...	3	858	1,843	+ 985	+114
	1855	...	...	...	...	...	7	2,887	3,924	+ 1,037	+ 36
WEST COAST OF AFRICA (Foreign Possessions)	1852	108	32,073	28,752	− 3,321	− 10	101	29,137	28,679	− 458	− 1
	1853	88	25,817	25,047	− 770	− 3	153	51,618	54,171	+ 2,553	+ 5
	1854	128	36,858	33,665	− 3,193	− 8	150	46,266	52,352	+ 6,086	+ 13
	1855	116	37,296	36,011	− 1,285	− 3	148	46,813	54,727	+ 7,904	+ 17
EAST COAST OF AFRICA	1852	4	1,471	1,438	− 33	− 2	1	262	87	− 175	− 66
	1853	...	...	...	...	...	1	178	113	− 65	− 36
	1854	...	...	...	...	...	2	626	768	+ 142	+ 22
	1855	1	174	107	− 67	− 39	2	406	105	− 301	− 74
SOUTH SEA ISLANDS	1852	...	...	...	...	...	6	1,339	529	− 810	− 60
	1853	1	181	70	− 111	− 61	3	729	671	− 58	− 8
	1854	...	...	...	...	...	6	2,267	2,409	+ 142	+ 6
	1855	1	296	130	− 166	− 56	4	1,396	1,370	− 26	− 2
GREENLAND AND SOUTH SEA FISHERIES	1852	54	15,009	3,783	− 11,226	− 74	54	15,058	100	− 14,958	− 99
	1853	63	16,226	4,347	− 11,879	− 73	67	16,982	51	− 16,931	− 99
	1854	52	14,596	2,180	− 12,416	− 85	55	14,702	...	...	...
	1855	58	16,763	3,987	− 12,776	− 76	56	15,189	...	...	...
BALTIC FLEET	1854	7	5,161	...	...	...	16	15,380	...	...	...
	1855	11	2,339	...	...	...	3	647	...	...	...
ALACRANE ISLANDS	1852	...	...	...	...	...	...	...	...	...	...
	1853	...	...	...	...	...	...	...	...	...	...
	1854	...	...	...	...	...	...	...	...	...	...
	1855	1	444	...	...	...	...	...	...	...	...
ARCTIC REGIONS	1852	...	...	...	...	...	...	...	...	...	...
	1853	...	...	...	...	...	2	574	...	...	...
	1854	...	...	...	...	...	...	...	...	...	...
	1855	...	...	...	...	...	...	...	...	...	...
CHANNEL ISLANDS	1852	1821	179,607	121,999	− 57,608	− 32	1560	137,881	75,717	− 62,164	− 45
	1853	1890	176,850	131,132	− 44,618	− 25	1486	128,546	71,557	− 56,989	− 44
	1854	2083	191,688	134,508	− 57,180	− 29	1570	137,206	79,286	− 57,920	− 42
	1855	1922	166,229	112,719	− 53,510	− 32	1442	118,920	76,976	− 41,944	− 35

* *Montrose*, sailing vessel. Registered number, 25,023. † *Tallentire*, sailing vessel, 261 tons register, Registered number, 25,629; and *Alice of Nantes*, Foreign sailing vessel, 194 tons register.

APPENDIX (CONTINUED.)

		IMPORTS.					EXPORTS.				
Name of Country.	Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo Carried.	Difference of Cargo, with reference to Tonnage.	Per Centage of Difference.
HELIGOLAND	1852	1	173	19	− 154	− 89	1	53	...	...	...
	1843	1	30	...	...	...	2	64	...	...	...
	1854	...	...	...	...	...	1	36	24	− 12	− 33
	1855	10	2,113	...	...	...	7	1,554	1,310	− 244	− 15
GIBRALTAR	1852	41	13,594	411	− 13,183	− 97	213	39,197	28,808	− 10,389	− 26
	1853	63	18,223	2,150	− 16,073	− 88	280	49,606	42,711	− 6,895	− 13
	1854	66	20,456	1,220	− 19.236	− 94	342	59,624	56,465	− 3,159	− 5
	1855	87	27,425	1,859	− 25,566	− 93	445	82,885	97,139	+ 14,254	+ 17
MALTA	1852	82	12,727	14,908	+ 2,181	+ 17	225	56,813	56,218	− 595	− 1
	1853	54	9,873	12,566	+ 2,693	+ 27	344	87,013	92,727	+ 5,714	+ 6
	1854	119	32,822	7,481	− 25,341	− 77	678	199,067	168,505	− 30,562	− 19
	1855	122	41,609	3,741	− 37,868	− 90	696	228,918	265,525	+ 36,607	+ 16
IONIAN ISLANDS	1852	36	4,555	4,756	+ 201	+	61	13,494	14,047	+ 553	+ 4
	1853	48	6,985	7,343	+ 358	+ 5	71	16,819	17,873	+ 1,054	+ 6
	1854	33	4,999	4,685	− 314	− 6	72	17,741	21,459	+ 3.718	+ 21
	1855	25	4,359	3,043	− 1,316	− 30	42	13,775	17,825	+ 4,050	+ 29
NORTH AMERICAN PROVINCES	1852	2219	951,756	1,255,277	+303,521	+ 31	1351	522,870	247,897	−274,973	− 52
	1853	2324	1,002,990	1,330,933	+327,943	+ 32	1423	568,596	321,106	−247,490	− 43
	1854	2812	1,262,016	1,463,016	+201,000	+ 13	1579	657,828	398,877	−258,951	− 39
	1855	1567	795,023	1,049,354	+254,331	+ 31	861	391,704	197,196	−194,508	− 49
WEST INDIES AND HONDURAS	1852	896	255,263	264,699	+ 9,436	+ 3	797	232,055	160,300	− 71,755	− 30
	1853	733	194,406	217,716	+ 13,310	+ 6	657	180,350	139,376	− 40,974	− 22
	1854	905	255,057	277,938	+ 22,881	+ 9	795	230,490	163,694	− 66,796	− 28
	1855	736	222,329	247,049	+ 24,720	+ 11	654	204,118	149,018	− 55,100	− 27
FALKLAND ISLANDS	1852	1	817	...	...	...	5	1,060	180	− 880	− 83
	1853	2	562	181	− 381	− 67	4	1,468	1,150	− 318	− 21
	1854	3	699	651	− 48	− 7	3	380	896	+ 516	+135
	1855	...	...	...	...	...	...	...	403	...	...
AUSTRALIA & NEW ZEALAND.	1852	159	75,275	48,767	− 26,508	− 35	586	346,010	96,716	−249,284	− 72
	1853	177	103,611	39,147	− 64,464	− 62	1225	565,252	313,197	−252,055	− 44
	1854	177	118,132	39,667	− 78,465	− 64	884	538,192	268,655	−269,537	− 50
	1855	161	104,120	41,028	− 63,092	− 60	465	350,751	168,111	−182,640	− 52
EAST INDIES AND SINGAPORE	1852	499	294,824	304,472	+ 9,648	+ 3	430	249,627	178,790	− 70,837	− 28
	1853	549	347,336	339,293	− 8,043	− 2	455	276,621	221,041	− 55,580	− 20
	1854	577	356,247	348,034	− 8,213	− 2	481	292,934	226,476	− 66,458	− 22
	1855	637	431,178	437,874	+ 6,696	+ 1	719	510,171	370,532	−140,639	− 27
CEYLON	1852	50	21,015	20,979	− 36	−·17	69	28,780	26.625	− 2,155	−
	1853	54	20,994	22,139	+ 1,145	+ 5	66	27,216	27,113	− 103	−·37
	1854	73	31,522	31,218	− 304	− ·9	78	31,418	35,317	+ 3,899	+ 12
	1855	60	27,514	26,471	− 1,045	− 3	36	30,302	21,538	− 8,764	− 28
ADEN	1852	1	1,176	...	...	...	48	26,445	34,977	+ 8,532	+ 32
	1853	1	202	209	+ 7	+ 3	40	24,179	28,510	+ 4,331	+ 17
	1854	...	...	...	...	...	43	25,879	32,465	+ 6,586	+ 25
	1855	...	...	...	...	...	53	23,668	36,871	+ 13,203	+ 55
MAURITIUS	1852	138	44,708	56,215	+ 11.507	+ 25	42	17,214	11,815	− 5,399	− 31
	1853	140	49,745	62,919	+ 13,174	+ 26	57	23,905	23,998	+ 93	+·03
	1854	197	67,330	83,895	+ 16,565	+ 24	49	19,799	14,280	− 5,519	− 27
	1855	156	56,024	68,875	+ 12,851	+ 22	62	24,626	13,820	− 10,806	− 43
CAPE OF GOOD HOPE	1852	66	17,249	11,933	− 5,316	− 30	157	45,847	42,682	− 3,165	− 6
	1853	39	10,416	5,488	− 4,928	− 47	183	51,411	50,322	− 1,089	− 2
	1854	51	13,990	9,745	− 4,245	− 30	77	20,531	21,052	+ 521	+ 2
	1855	69	17,228	11,311	− 5,917	− 34	106	30,782	32,121	+ 1,339	+ 4
WEST COAST OF AFRICA	1852	77	20,423	13,416	− 7,007	− 34	80	20,258	12,140	− 8,118	− 40
	1852	72	23,559	10,905	− 12,654	− 53	83	25,995	12,938	− 13,057	− 50
	1854	53	15,114	10,986	− 4,128	− 27	58	15,195	11,498	− 3,697	− 24
	1855	50	13,953	12,341	− 1,612	− 11	71	18,870	14,980	− 3,890	− 20
ST. HELENA AND ASCENSION	1852	3	1,028	1,077	+ 49	+ 4	23	6,267	4,919	− 1,348	− 21
	1853	4	1,024	7	− 1,017	− 99	23	7,211	6,655	− 556	− 7
	1854	2	190	246	+ 56	+ 29	14	3,718	2,867	− 851	− 22
	1855	1	340	307	− 33	− 8	14	3,090	1,573	− 1,517	− 49
SETTLEMENTS OF HUDSON'S BAY COMPANY	1852	...	...	1,221	...	...	...	...	1,012	...	...
	1853	...	...	1,095	...	...	...	...	904	...	...
	1854	...	...	1,346	...	...	...	...	1,153	...	...
	1855	...	...	1,206	...	...	...	...	958	...	...

GENERAL SUMMARY.

	IMPORTS.					EXPORTS.				
Date.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo, with reference to Tonnage.	Per Cent. of Difference.	No. of Vessels.	Register Tonnage.	Tons Weight of Cargo carried.	Difference of Cargo, with reference to Tonnage.	Per Cent. of Difference.
1852	38,051	7,887,447	6,169,599	−1,717,848	−21	39,361	8,242,702	6,418,245	−1,824,457	−22
1853	42,876	8,943,106	7,525,063	−1,418,043	−15	44,779	9,447,104	7,316,457	−2,130,647	−22
1854	41,591	9,161,366	7,290,996	−1,870,370	−20	43,494	9,507,721	7,639,473	−1,868,248	−19
1855	40,980	8,951,239	6,254,259	−2,696,980	−30	42,597	9,538,231	8,370,363	−1,167,868	−12

11, Buckingham-street, London, W.C., June, 1858.

HENRY WRIGHT.

APPENDIX (CONTINUED.)

STATEMENT ABSTRACTED FROM A RETURN OF THE HOUSE OF COMMONS, SHOWING THE TOTAL NUMBER OF STEAM VESSELS REGISTERED IN THE UNITED KINGDOM ON OR BEFORE THE 1st JANUARY, 1855, AND THE PER CENTAGE OF DEDUCTION FROM GROSS TONNAGE, ALLOWED FOR ENGINE ROOM, DISTINGUISHING WHETHER WOOD OR IRON PADDLE, AND WOOD OR IRON SCREW VESSELS.

No. of Iron Paddle Vessels.	Per Centage of Deduction from Gross Tonnage for Engine-room.
1	13
2	15
1	17
2	18
1	20
5	22
1	23
4	24
4	25
5	26
5	27
7	28
6	29
23	30
8	31
12	32
9	33
13	34
15	35
15	36
9	37
8	38
12	39
13	40
12	41
7	42
5	43
10	44
8	45
6	46
5	47
4	48
7	49
5	50
1	51
1	53
1	54
1	55
2	56
2	57
1	58
2	59
1	60
3	63
1	65
1	68
1	69
1	72
1	74
1	75
1	81
1	82
1	92
TOTAL—274	

No. of Iron Screw Vessels.	Per Centage of Deduction from Gross Tonnage for Engine-room.
1	5
1	7
1	9
1	10
1	11
2	15
4	16
3	17
10	19
6	20
5	21
14	22
8	23
17	24
13	25
11	26
18	27
12	28
19	29
12	30
7	31
13	32
12	33
3	34
4	35
5	36
3	37
6	38
7	39
6	40
9	41
4	42
1	43
1	45
6	46
2	47
2	48
2	49
4	50
1	51
2	52
1	55
1	57
1	60
1	63
1	74
264	

No. of Wooden Paddle Vessels.	Per Centage of Deduction from Gross Tonnage for Engine-room.
1	12
1	15
1	17
2	19
2	20
1	21
1	22
5	23
5	25
6	26
4	27
8	28
8	29
24	30
13	31
18	32
26	33
23	34
23	35
17	36
28	37
20	38
18	39
37	40
21	41
14	42
23	43
20	44
10	45
18	46
10	47
7	48
3	49
18	50
8	51
10	52
5	53
12	54
6	55
18	56
11	57
12	58
15	59
18	60
13	61
15	62
20	63
17	64
24	65
26	66
19	67
17	68
40	69
742	

No. of Wooden Paddle Vessels. (*Continued.*)	Per Centage of Deduction from Gross Tonnage for Engine-room.
742	
31	70
18	71
19	72
16	73
14	74
7	75
10	76
2	77
2	78
2	79
1	80
1	81
2	82
1	85
1	88
2	89
871	
60*	
931	

No. of Wooden Screw Vessels.	Per Centage of Deduction from Gross Tonnage for Engine-room.
1	22
1	24
1	25
1	26
2	29
1	30
1	35
1	38
1	54
10	

SUMMARY OF TABLE.

Iron Paddle Vessels............	274
Iron Screw Vessels	264
Wooden Paddle Vessels......	931
Wooden Screw Vessels	10
Wood and Iron Paddle (with 26 per cent. deduction from gross tonnage for engine-room)	1
Total..................	1480

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* The full data are not given to enable the calculations to be made, in the case of these 60 wooden-paddle vessels.

HENRY WRIGHT.

THE CAMPANA COLLECTION.

The following is extracted from the *Times*:—

Letters from Rome speak of the intended sale of the extremely remarkable collection* of antiquities and works of art belonging to the Marquis Campana, a collection with which most English visitors to the Eternal City are probably acquainted. It is estimated to have cost 6,000,000f., or £240,000, and assuredly the instances must be very rare of one of a similar extent having been made by a private individual. It fills a vast number of rooms, in three or four different houses. Various suggestions have been made as to the manner in which it should be disposed of; one, among others, being that it should be purchased *en bloc* by the Sardinian Government, as the nucleus (and truly a very considerable one) of a public museum in that country, at present wanting. It is unlikely, however, that the Government would propose, or the Chambers vote, the large grant that would certainly be needed for its acquisition. We have been promised that there shall be no more loans, and the budget is already sufficiently burdened with the expenses of public works greatly needed, and of fortifications deemed equally necessary. Unless, however, some Government buys it in a lump it will doubtless be dispersed, for no individual is likely to make such an enormous purchase. There have been many reports as to what would be done with it, and an auction has been talked of, but nothing seems at present decided, although something probably soon will be, and I believe it is certain that the administrator of the estate is at present open to offers. The collection may be broadly divided into 12 classes, some of which are exceedingly rich and valuable, others less worthy of note. Among the latter must be classed the paintings, although these comprise some remarkable works, including the frescoes from Raphael's two villas on the Palatine and Pincian hills, and although many of the others will be highly interesting to amateurs of the pre-Raphaelite period. The pictures are about 650 in number. Among the most precious portion of the collection must be classed the Etruscan vases, nearly 3,800, divided into 15 series. It is said to be the finest collection of this kind in existence; indeed, in Etruscan art generally the Campana museum is considered unrivalled. The great number of the objects strikes all visitors with surprise. One most elegant vase, beautifully preserved, adorned with delicate relievos of figures, foliage, and animals, with gildings and bright colours, has been preferred by some antiquaries to the Portland vase. A very large sum was given for it by its enterprising owner. The collection of gold ornaments, jewellery, and bronzes is as remarkable as that of the vases, and the same may be said of the terra cottas, and little less of the very interesting class of glass and enamels. There are some beautiful ancient arms, among which two ancient casques (Etruscan), wreathed with golden leaves of laurel and ivy, and perfectly preserved, strike the eye and attract general admiration. There is another helmet, of solid silver, partially but admirably chased. The collection of sculpture comprises several hundred busts and statues, many of great merit and some celebrated. The gems, cameos, and numismatic collection are all in a number and importance rarely found in private cabinets. I do not enumerate all the classes, still less attempt to speak of their subdivisions or venture upon criticism of individual objects, although I recently went over the greater part of the collection, and was fortunate enough to do so in company with one of our most approved English connoisseurs. But the most incompetent appreciator of art and antiquities cannot but be struck with admiration of the great beauty of the collection, and by the rarity and curiosity of the relics—most of them very well preserved—which are there displayed. As to the extent, some of the numbers above cited will help to form an idea of it. The terra cottas and objects of plastic art are nearly 2,000 strong, and reputed without a rival as a collection. There is a whole suite of rooms full of majolica. In the way of art and antiquities, Rome is such an inexhaustible museum, such a labyrinth of wonders, that collections which would make the reputation of other cities may there be almost lost in the crowd. Even in Rome, however, the Campana Museum will hardly be omitted from the list of persons who have but a short time to devote to the treasures of the Papal capital, and it should the less be neglected since there is a great probability of its being soon broken up and scattered abroad.

MANUFACTURE OF CLOTHING BY MACHINERY.

In evidence recently given before the Army Contracts' Commission, Mr. Peter Tait, of Limerick, said that the whole of his clothing was cut and sewn by machinery driven by steam, and capable of making 4,000 suits a-week. It was owing to the encouragement he had received from Sir Thomas Troubridge, at the War office, that he had carried the practical application of machinery so far. He could now clothe the whole of the British army, assuming that 250,000 suits would be required annually; and, on an emergency, with the steam power at his command, he could furnish 100,000 suits a-week to the Government. He employed about 1,100 people, and no man at wages lower than a guinea a-week.

Home Correspondence.

THE SHIPS OF THE ROYAL NAVY.

Sir,—The letters of Sir John Rennie and Mr. MacGregor, in the last number of your *Journal*, require a line or two from me.

I have been fortunate in eliciting from Sir John a statement of the very interesting facts recorded by him. Now that he has made them public, they will, I doubt not, be duly considered by future writers on the Navy. But my omission of them is no evidence of neglect. Even if my time and space had permitted their introduction into my paper, I could scarcely have narrated them; for, notwithstanding some considerable research, they were unknown to me until the proof-sheets of the paper were corrected, and I was on the point of addressing your Society. The work on which I chiefly relied respecting the earliest actual introduction of steam into the Royal Navy, is the autobiography of Sir John Barrow, who had excellent opportunities of learning much about it, and few inducements, I should think, to exaggerate what he knew. According to him, "the ingenious Brunel" took up the question of the propulsion of ships of war by steam, made experiments on the subject early in 1816, and wrote an encouraging letter upon the results to Lord Melville. These statements, while they neither clash with Sir John Rennie's, nor diminish the honour due to him and his eminent kinsmen, indicate that the future historian will have to scrutinize the claims of more than one of our greatest engineers somewhat closely, before he discovers all the truth of the matter. I regret that I cannot agree with Sir John on one point. I cannot see how the towing of the *Hastings* by a Margate steamer "may fairly be considered the first introduction of steam into the Royal Navy."

There is a remark in Mr. MacGregor's letter which is, at least, susceptible of an interpretation adverse—unfairly so, I think—to myself. He says, "it is extraordinary that men will continue to compare the tonnage of vessels, as if a proper standard were actually in use, when it is generally acknowledged that the engine-power and tonnage capacity are both estimated by a calculation wholly illusory." This seems to me to imply either that I (of whose paper he is writing) compared tonnages improperly, or that the rules for calculating tonnage are so "wholly illusory" that tonnages necessarily mislead, whenever and however compared. I can admit neither of these implications. In the first place, I made no comparison of tonnages, except in the case of the *Shannon* and *Merrimac*, and even in that case I simply quoted Captain Dahlgren's admission—to the effect that the latter vessel is of greater tonnage than the former—and accepted it, in order to account for the inferiority of the *Shannon's* armament. I was aware that Captain Dahlgren's estimate was not literally correct, for the difference between the tonnages of the two ships (when both are calculated by the English rule) is much greater than he represented, the *Shannon* being of 2651, and the *Merrimac* of 3500; but for the purpose of my argument his admission was ample, and I therefore contented myself with accepting it. It will be seen from this that in my only comparison of tonnages I was most careful to avoid error—more careful, probably, than Mr. MacGregor supposed me. In the second place, it cannot for a moment be admitted that, with the relative tonnages given above, the *Shannon* may yet be as large a ship as the *Merrimac*. It would be pushing the defects of the existing rules much too far to suppose that.

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* A catalogue of the Collection has been presented to the Society's Library.

Apart from its application to myself, I cannot assent to Mr. MacGregor's proposition, that "it is extraordinary that men will continue to compare the tonnages of vessels." They must, for general purposes, compare tonnages (calculated by the same rule, of course), or else give up comparing vessels altogether; for they have at present, at least, no better basis of comparison. In saying this, I am not implying that the rules for calculating tonnage are either perfect or satisfactory; they are neither. But they are better than none, and better than any other existing and recognised means of comparing the sizes of vessels.

As for myself, I avoided, in my paper, all use and mention of these rules. Their improvement is a subject I was not called upon to discuss; and a subject, moreover, which has lately had such a mountain of big, rugged, and ponderous words heaped upon it, that I felt no inclination to voluntarily attempt its exhumation before the eyes of the learned, and, as I found, very generous members of your Society. I am, &c.,

E. J. REED.

Mechanics' Magazine Office, 166, Fleet-street,
London, Jan. 5, 1859.

Proceedings of Institutions.

HITCHIN MECHANICS' INSTITUTION.—The last report of the Institution speaks favourably of its prosperity. The library has, during the past year, been more extensively used than in any previous year; the number of entries in the librarian's book has been steadily increasing year by year since 1853, when 1385 volumes were taken out—this year 3,469 volumes have been entered by members for perusal, averaging 289 books per month. The books read during the past year have been of the following classes:—48 on theology; 484 on arts, sciences, and philosophy; 551 on voyages and travels; 443 on history; 556 on biography; 383 on fiction; 77 on poetry and the drama; 927 on miscellaneous literature. The committee, consequently, feel encouraged in their efforts to enlarge the library, especially in those classes of books which are most frequently read by the members; and they express their satisfaction that the books which have the largest circulation are of the most useful and instructive character. During the year, seventy-three volumes have been purchased by the committe, at a cost of £17 11s. 11d. The library has also been increased by two valuable presents of books. Sixteen lectures, on various subjects, have been delivered during the season—the expenses attendant upon which have amounted to £51 19s. 9d., and the receipts for admission have amounted to £54 14s., leaving a profit of £2 14s. 3d. On comparing this with previous years, the sum will appear a very small one, and this arises from the great reduction in the charges for admission. The new scale, admitting the families of members at half-price, has the effect of reducing by about one-half the amount received at each lecture; had this rule not existed, judging from previous years, there would most probably have been a profit of £20. The committee direct particular attention in their report to the advantages offered to members from the connexion of the Institution with the Society of Arts, especially with regard to the examinations. The treasurer's report shows an income of £139 9s. 10d., and an expenditure of £131 5s. 5d.; the Institution remains entirely free from debt, and has a clear balance of £8 4s. 5d. in hand.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Prof. Huxley, "On Biology."
British Architects, 8.
Medical, 8.
Geographical (Burlington House), 8½. I. "Notes on the Zambesi Expedition from the Journal of Thomas Baines, Esq." Communicated by Dr. Livingstone. II. Mr. E. G. Squier, "An Account of the Lake Tojoa or Toulebé in Honduras or Central America." III. "Journal of a Voyage in Mexico by Mr. Charles Sevin."
TUES. ......Syro-Egyptian, 7½. Messrs. Sharp and Bonomi, and Dr. Camps, "On the triple mummy case of Aroerido, an Egyptian Priest."
Civil Engineers, 8. Discussion on Mr. Scott's Paper, "On a Breakwater at the Port of Blyth," &c.
Med. and Chirurg., 8.
Zoological, 9.
WED. ......London Inst., 3. Mr. T. Rymer Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Literary Fund, 3.
Graphic, 8.
Archæological Assoc., 8½.
THURS. ...Royal Society Club, 6.
London Inst., 7. Mr. George MacDonald, "On the Poetry of the 16th Century."
Antiquaries, 8.
Philological, 8.
Royal, 8½.
FRI.........Astronomical, 8.
SAT. ......London Inst., 3. Mr. T. A. Malone, "On the Metallic Elements and their Principal Salts and Alloys."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, December* 31, 1858.]

Dated 6th December, 1858.

2788. J. G. Arnold, Worcester, Massachusetts, U.S.—Imp. in envelopes for letters and similar purposes.
2790. J. Muir, Glasgow, and F. Muir, Paisley—Imp. in ornamental or colour printing.
2792. J. Dawson, Holbeck, Leeds—Imp. in machinery or apparatus for raising the nap on woollen cloths.
2794. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of gloves. (A com.)
2796. E. W. Scale, Merthyr Tydvil, Glamorganshire—Imp. in railway and other breaks.

Dated 7th December, 1858.

2798. W. A. Gilbee, 4, South-street, Finsbury—An improved portable bath. (A com.)
2800. J. Whiteley and T. Kitchenman, Halifax—Imp. in press plates or apparatus employed in hot pressing woven fabrics.
2802. J. J. Harris, Woodlesford, near Leeds—Imp. in apparatus for refrigerating and regulating the temperature in worts and beer, which may also be employed as condensers in distilling.
2806. W. Burness, 2, Prospect-terrace, Brixton—Imp. in pumping and forcing liquids.
2808. J. Ferrabee, Phœnix Iron Works, and F. H. England, Foomhall Mills, Stroud—Imp. applicable to machinery for carding, scribbling, and condensing wool and other fibrous substances.

Dated 8th December, 1858.

2810. G. F. Chantrell, Liverpool—Imp. in apparatus applicable to the manufacture and revivification of animal or vegetable charcoal.

2812. R. L. P. Manning, Princes-square, Middlesex—A floating paddle wheel.
2814. S. Phillips, Moseley, near Birmingham—Imp. in sliding window sashes, shutters, and doors.
2816. W. King, jun., Guildford—Imp. in apparatus for roasting coffee and other substances.
2818. H. Meidinger, University of Heidelberg, Germany—Imp. in electric batteries.

Dated 9th December, 1858.

2820. J. Barrow, junr., Manchester—Imp. in the treatment of coal gas tar, and of the oils obtained by the distillation of the same, and for the application of substances obtained thereby.
2822. J. Eccles, Blackburn—Imp. in arrangements and machinery for preparing for manufacture and for manufacturing clay and other plastic earths into bricks, tiles, pipes, and other articles formed of such materials.
2824. J. Little, Glasgow—Imp. in fire grates and heating apparatus.
2826. J. Stewart, 69, Tottenham-court-road—Imp. in the construction of the action of pianofortes.
2828. J. Wilson, Wansford, Northamptonshire—Imp. in machinery for tilling and cultivating land.

Dated 10th December, 1858.

2834. J. Flockton, junr., Manchester—Imp. in stop or reversing taps.
2836. A. Barclay, Kilmarnock, N.B.—Imp. in obtaining motive power by means of electricity, magnetism, and electro magnetism.
2838. W. Beardmore, Deptford—Imp. in steam boilers.
2840. G. W. B. Kiallmark, Bridgewater, and W. T. Timewell, North Wharf-road, Paddington—Imp. in the manufacture of cements.

Dated 11th December, 1858.

2842. J. B. Guthrie, Manchester—Imp. in the manufacture of india-rubber overshoes.
2844. J. Hinks, Birmingham—Imp. in ships' and other lamps.
2846. C. J. Richardson, 34, Kensington-square—Imp. in apparatus to be applied to chimneys or flues of buildings, for economizing heat and reducing the quantity of smoke passing into the atmosphere.
2848. W. E. Wiley, 34, Great Hampton-street, Birmingham—Imp. in ever-pointed pencils.

Dated 13th December, 1858.

2850. J. A. Carruthers and T. Blackburn, Blackburn, Lancashire—Imp. in apparatus for guiding and regulating the warp threads in the operations of warping tape-sizing, looming and weaving.
2851. R. Whittam, Accrington—Imp. in machinery, or apparatus, for tracing designs from an engraved roller, or from an engraver's sketch upon steel or other metallic surfaces, used as dies by engravers to calico printers.
2852. L. C. V. Yon, Lisieux, France—Improved elastic beds.
2853. J. M. Roussel, 8, Impasse des Couronnes, Belleville, near Paris—A new system and new apparatus, using air as a motive power.
2854. J. E. Boyd, Hither-green, Lewisham—Imp. in candlesticks, lamps, and lanthorns.
2855. R. A. Brooman, 166, Fleet-street—Imp. in twisting and otherwise operating upon threads, twine, or cords, and in apparatus for performing the same. (A com.)
2856. R. A. Brooman, 166, Fleet-street—Imp. in the manufacture of cranked axles and shafts. (A com.)
2857. E. Loomes, Whittlesea, Cambridgeshire—An imp. in the construction of steam engines.
2858. J. Ferrabee, Phœnix Iron Works, Stroud—Imp. in the construction of steam engines, and in the mode of working the same.

Dated 14th December, 1858.

2859. J. Webster, Birmingham—A new or improved method of recovering copper and zinc from liquids which have been employed to dip or pickle articles made of brass or other alloys containing copper and zinc.
2860. E. Bow, Port Dundas, Lanark, N.B.—Imp. in pumps.
2861. D. Anderson, Glasgow—Imp. in taps or valves.
2862. J. Wade, Bradford—Imp. in means or apparatus employed in weaving.
2863. G. W. Baker, Park Farm, Woburn, Bedfordshire—An improved construction of manger fastening.
2864. R. A. Brooman, 166, Fleet-street—An imp. in transmitting electric telegraph signals.
2865. J. T. Smets, Plaçamen, France—A method of making vinegar from a refuse product obtained in the manufacture of starch.
2866. F. Jossa, Bishop Auckland, Durham—Imp. in furnaces for generating steam and other purposes.

Dated 15th December, 1858.

2867. J. Pendlebury, Crumpsall, Lancashire—Certain imp. in machinery or apparatus for bleaching or cleansing textile fabrics or materials.
2868. D. Rowan, Greenock—Imp. in steam engines.
2869. H. Bridges, Bridgwater—Imp. in the means of working breaks on carriages on railways.
2870. F. C. N. J. V. Migeon, Morvillars, France—Imp. in manufacturing screws, rivets, nails, spikes, and all similar articles made of metallic wire, and in the machines connected therewith.
2871. A. V. Newton, 66, Chancery-lane—Improved machinery for manufacturing bullets. (A com.)
2872. A. V. Newton, 66, Chancery-lane—An improved arrangement of condensing apparatus. (A com.)
2873. J. Bullouga, Blackburn—Imp. in looms.
2874. C. F. Vasserot, 45, Essex-street, Strand—An improved pendulum governor for regulating the supply of steam to the cylinders of marine engines. (A com.)
2875. W. Clark, 53, Chancery-lane—Improved agricultural implements.
2876. J. Wardill, Commercial-road East—An improved stopper or controller, to stop and control the running out of chains and ropes.
2877. G. Bell, Wandsworth—An imp. in matches and fusees.
2878. T. Moss, Gainsford-street, Islington—Imp. in printing bank-notes, bills of exchange, and other documents requiring like security against being copied.
2879. W. Morgan, Witton-park Iron Works, near Darlington, Durham—Imp. in the manufacture of iron.

Dated 16th December, 1858.

2881. W. H. Carmont, 2, Rosamond-place, Upper Brook-street, and W. Corbett, 22, Blantyre-street, Chester-road, Manchester—An improved mode of constructing furnaces for the production of wrought iron and steel, and manufacturing such metals into ingots and other forms.
2882. A. Stokes and F. J. Stokes, Birmingham—New or improved machinery for the manufacture of screws.
2883. R. Mushet, Coleford, Gloucestershire—A new or improved manufacture of cast steel.
2885. J. W. Edge, Manchester—A certain imp. in balls, bullets, or other projectiles to be employed in fire-arms or ordnance.
2886. J. W. Friend, Freemantle, Southampton—Improved apparatus for ascertaining and registering the depth and flow of liquids, and the distances run by ships at sea.
2887. A. Mackenzie, Glasgow—Imp. in sewing machines.
2888. J. J. Marçais, Paris—Imp. in galvanic batteries.
2889. W. White and J. Parlby, Great Marylebone-street—Imp. in the preparation or treatment of "carton pierre," and such like composition, and in the application thereof to the coating or covering of walls and other surfaces.
2890. R. A. Brooman, 166, Fleet-street—An imp. in plating and gilding forks, spoons, and other metal articles. (A com.)
2891. W. Clark, 53, Chancery-lane—Imp. in submarine electric telegraph cables or conductors. (A com.)

Dated 17th December, 1858.

2892. J. J. Aston, 41, Doughty-street, Middlesex—Imp. in machinery or propellers applicable for the propulsion of ships' boats and other vessels on and through the water, and in the propelling of all such vessels on and through the water by means of such propellers.
2893. W. B. Johnson, Manchester—Imp. in machinery or apparatus for preparing for joining the rails of railways.
2894. J. Inshaw and J. Inshaw, Birmingham—An imp. or imps. in locomotive engines.
2895. A. Hinde, Wolverhampton—Imp. in treating or preparing the cinder or slag from puddling furnaces for the purpose of facilitating the manufacture of iron therefrom.
2896. J. Kerr, 17, Bedford-terrace, Trinity-square, Southwark—Imp. in the construction of revolving fire-arms.
2897. J. Clegg, Keighley, Yorkshire—Imp. in lubricating the valves and pistons of steam engines.

Dated 18th December, 1858.

2899. J. Aitken and J. Brooks, Irwell Vale Mill, Edenfield, near Bury—Imp. in looms.
2901. A. Mitchell, Glasgow—Improved apparatus for registering the speed of engines and other machinery.
2903. A. P. How, Mark-lane—Imp. in cocks or stop valves.
2905. J. Soutter, Edinburgh—Imp. in apparatus for drying or airing linen or other articles of wearing apparel.

Dated 20th December, 1858.

2907. T. S. Woodcock, Salford—An improved index or book and paper marker.
2909. R. Maclehose, Ayr, N.B.—Imp. in stereoscopes.
2911. A. V. Newton, Chancery-lane—An imp. in lanterns. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *Dec.* 31, 1858.]

December 31st.

1476. T. Whiteley.
1479. T. Blinkhorn.
1480. T. Riddell.
1487. P. R. Hodge & G. Spencer.
1492. D. Le Souef.
1493. T. Scott.
1494. J. Billing.
1497. T. Restell.
1498. W. Bond and T. Standing.
1500. J. G. Jennings & T. Culpin.
1502. J. G. Jennings.
1504. J. G. Jennings and J. Lovegrove.
1505. E. Haeffely.
1507. R. A. Brooman.
1516. W. E. Newton.
1536. P. R. Hodge.
1555. W. Langshaw.
1633. J. Shand.
1661. R. P. Walker.
1921. H. B. Barlow.
1929. R. A. Brooman.
2103. J. H. Gresham.
2255. A. Miller.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette*, *Dec.* 31, 1858.]

December 28th.

2938. G. Chisholm.
50. C. A. Hanson & J. Wormald.

December 29th.

2949. S. Lees, E. Lees, and G. H. Newton.
36. E. H. Bentall.
87. W. Smith.

[*From Gazette*, *Jan.* 4, 1859.]

December 30th.

5. W. B. Johnson.
25. C. Mather & C. Millward.
27. J. Fowler, jun.

December 31st.

2952. Sir J. S. Lillie.

January 1st, 1859.

136. J. Schloss.

Journal of the Society of Arts.

FRIDAY, JANUARY 14, 1859.

◆

SWINEY BEQUEST.

A meeting of the judges appointed under the will of the late Dr. Swiney is hereby summoned to be held on Thursday, the 20th of January instant (being the anniversary of his death), when the bequest under the said will, in favour of the "author of the best published Treatise on Jurisprudence," will be adjudged. The meeting will take place at four o'clock, p.m.

(By order) P. LE NEVE FOSTER,
Secretary.

EXHIBITION OF 1861.

The following letter has been addressed to the Members of the Society resident in London:—

Society of Arts, Manufactures, and Commerce, Adelphi,
London, W.C., 30th December, 1858.

Sir,—The Council of the Society of Arts, in considering the best means of setting on foot another Exhibition in the year 1861, must request the co-operation of the whole of the gentlemen who, from the very fact of their being members of the Society of Arts, may be considered to have the "Encouragement of Arts, Manufactures, and Commerce" at heart.

1. I am therefore to request that you will be good enough to favour the Council with any observations which your experience may suggest upon the best mode which may be adopted of representing the industry of the metropolis, and particularly of any branch of it in which you may happen to be directly or indirectly interested.

2. They would request you to state, at your earliest convenience, whether any and what improvement you consider could be made on the arrangements of 1851.

3. Whether the conditions sketched out in the resolutions of the Council, published in the 282nd number of the *Journal*, and again in the opening address of the Chairman of the Council, require any modification or extension.

4. Whether you consider that the formation of metropolitan committees would be of use in discussing the preliminary details, and whether there is any particular class of industry upon the committee of which you would prefer to serve. You must be good enough to understand that the functions of such committees must in the first instance be purely deliberative, as the Council are unable to decide how and by what agency the Exhibition will be conducted until they receive from the Commissioners of the Exhibition of 1851 a reply to their application. You may, however, be assured that whatever thought and attention you may be good enough to devote to the subject will be of great advantage to the undertaking.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

The following letter has been addressed to the Members of the Society resident in the country:—

Society of Arts, Manufactures, and Commerce, Adelphi,
London, W.C., 30th December, 1858.

Sir,—The Council of the Society of Arts, in considering the best means of setting on foot another Exhibition in 1861, must request the co-operation of the whole of the gentlemen who, from the very fact of their being members of the Society of Arts, may be considered to have the "Encouragement of Arts, Manufactures, and Commerce" at heart.

1. I am therefore directed to request that you will be good enough to favour the Council with any observations which your experience may suggest upon the best mode which may be adopted of representing the industry of your locality in the contemplated Exhibition.

2. They would request you to state, at your earliest convenience, whether any and what improvement you consider could be made on the arrangements of 1851.

3. Whether the conditions sketched out in the resolutions of the Council, published in the 282nd number of the *Journal*, and again in the opening address of the Chairman of the Council, require any modification or extension.

4. Whether you consider that the formation of a committee in your locality would be of use in discussing the preliminary details, and whether you are willing to serve as a member of such committee; and if so, in reference to which of the thirty classes. You must be good enough to understand that the functions of such a committee must in the first instance be purely deliberative, as the Council are unable to decide how and by what precise agency the Exhibition will be conducted until they receive from the Commissioners of the Exhibition of 1851 a reply to their application. You may, however, be assured that whatever thought and attention you may be good enough to devote to the subject will be of great advantage to the undertaking.

Should the formation of a committee be recommended, it might probably be convenient to request the committee of one of the Institutions in Union with the Society to allow the Exhibition Committee to meet in their rooms.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

EXAMINATIONS, 1859.

The following circular has been issued to the Institutions in Union:—

Society for the Encouragement of Arts, Manufactures,
and Commerce, Adelphi, London, W.C.,
10th January, 1859.

Dear Sir,—In the Programme of the Examinations for 1859, the Council gave notice that, as the subjects of "Navigation and Nautical Astronomy," "Astronomy," "Botany," "Agriculture," and "Political and Social Economy," were taken up in 1857 and 1858 by fewer than four Candidates, no Paper would be set for the Final Examinations by the Society's Examiners in 1859, in any of those five subjects, unless the Council should be informed, before the 1st of February next, that Ten Candidates are preparing themselves for the Previous Examinations in those subjects.

I am, therefore, directed by the Council to request that, if you know of any Candidates who are preparing themselves for Examination in any one of those five subjects, you will be so good as to write to me, before the 1st of February next, without fail, specifying the number of such Candidates, and the subjects for which they are respectively preparing.

The Society's *Journal* of the 4th of February next will state whether a sufficient number of Candidates has been announced to warrant the setting of Papers in any of the five subjects.

I am, dear Sir, yours faithfully,
P. LE NEVE FOSTER, Secretary.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards of Examiners have been appointed since the last announcement:—

For Aberdeen.

Mr. J. S. Brazier, Lecturer on Agricultural Chemistry, Marischal College.
Dr. Cruickshank, Prof. of Mathematics, Marischal Coll.
Rev. James Fraser, of St. Clement's parish.
Mr. Edward Hennessey, Teacher of Navigation, Regent's Quay.
Mr. David Maver, Teacher, Free Bon-Accord School.
Mr. J. C. Maxwell, Prof. of Natural Philosophy, Marischal College.
Mr. Wm. Rattray, Teacher, Free South Church School.
Mr. James Sinclair, *Secretary.*

For Ashford (South-Eastern Railway Mechanics' Institution).

Rev. J. P. Alcock, Vicar of Ashford.
Mr. Jas. Cudworth, Locomotive Superintendent, S.E. Railway, Ashford.
Mr. John Keene, Accountant, S.E. Railway, Ashford.
Mr. Richard C. Mansell, Carriage Superintendent, S.E. Railway, Ashford.
Mr. Francis Garroway, Schoolmaster, 112, New Town, Ashford, *Secretary.*

For Banbury.

Mr. J. H. Beale, Schoolmaster.
Mr. T. A. Hedley, C.E.
Mr. A. B. Rye, M.R.C.S., Banbury.
Rev. Wm. Wilson, Vicar of Banbury.
Mr. Tom Hedley, *Secretary.*

For Basingstoke.

Rev. Matthew Harrison, Rural Dean, Church Oakley, Hants.
Mr. Robert Southey Hill, Surgeon, Basingstoke.
Rev. W. B. Lightfoot, Head Master of the Queen's Grammar School, Basingstoke.

For Bristol.

Rev. Canon Girdlestone, M.A., Royal York-crescent, Clifton, *Chairman.*
Mr. G. C. Ashmead, 1, Alma-vale, Clifton.
Mr. G. H. Bengough, The Ridge, near Bristol.
Rev. J. Bowman, M.A., Principal of Bishop's College, Bristol.
Rev. J. Burder, M.A., South Parade, West Clifton.
Mr. Jas. Carnock, Richmond-hill, Clifton.
Mr. J. A. Cooke (late Mayor), Windsor-terrace, Clifton.
Mr. J. D. Corfe, 31, Richmond-terrace, Clifton.
Earl Ducie, Tortworth Court, Gloucestershire.
Mr. P. H. Edlin, Lennox-villa, Clifton.
Rev. G. Elliott, D.D., Dean of Bristol, Deanery, College-green, Bristol.
Sir A. H. Elton, Bart., Clevedon Court, near Bristol.
Mr. R. E. Ferrier, Fine Arts Academy, Clifton.
Rev. Professor Gotch, Baptist College, Stokes Croft, Bristol.
Mr. F. W. Griffin, Ph.D., Kingsdown-parade, Bristol.
Mr. J. S. Harford, F.S.A., Blaize Castle, Hinbury, near Bristol.
Rev. N. Haycroft, M.A., Portland-square. Bristol.
Mr. M. D. Hill (H.M. Commissioner in Bankruptcy for Bristol District), Heath House, Stapleton, near Bristol.
Mr. C. T. Hudson, M.A., Principal of Grammar School, Bristol.
Mr. W. Kay, M.D., Caledonia-place, Clifton.
Mr. W. H. G. Langton, M.P., Clifton Court, Clifton.
Mr. D. Mackie, M.R.S.A., Queen's-square, Bristol.
Mr. Henry Owgan, LL.D., 7, Albemarle-row, Clifton.
Rev. Jas. Robertson, A.M., 1, Apsley-place, Dendham Down.
Rev. D. Thomas, B.A., Hillside, Cotham, Bristol.
Mr. F. F. Tuckett, Frenchay, near Bristol.
Mr. R. H. Webb, Berkeley-square, Clifton.
Sir J. E. Wilmot, Bart. (Judge of County Court), Bristol.
Rev. J. R. Wreford, D.D., St. Michael's-hill, Bristol.
Mr. J. F. R. Daniel, Athenæum, Bristol, *Secretary.*

For Wigan.

Mr. Joseph Ingram, Freckleton, Wigan, *Chairman.*
Mr. Jos. Acton, Wigan.
Mr. Baines, Marsden-square, Wigan.
Mr. W. A. Barrow, solicitor, Wigan.
Rev. D. Blyth, Wigan.
Mr. J. T. Fitzadam, barrister, Wigan.
Mr. Wm. Holt, book-keeper, Poolstock, Wigan.
Mr. Marsden, book-keeper, Marsden-square, Wigan.
Mr. James Mitchell, District Bank, Wigan.
Mr. Maskell Pease, solicitor, Wigan.
Mr. R. Smith, Mechanics' Institution, Wigan.
Rev. W. T. Whitehead, Ince Parsonage, Wigan.
Mr. Thos. F. Fergie, *Hon. Secretary.*

For Windsor.

Rev. W. C. Bromehead, 10, York-place, Windsor.
Mr. Thos. Chamberlain, Thames-street, Windsor.
Mr. Joseph Lundy, Victoria-street, Windsor.
Mr. Frederick Twinch, Peascod-street, Windsor.
Mr. Alfred Williams, National Schools, Windsor.
Mr. Chas. T. Phillips, Sheet-street, Windsor, *Hon. Sec.*

This Board is willing to conduct the Examination of Candidates from Institutions within a radius of ten miles from Windsor.

ON THE CULTURE OF FOOD.

By W. Bridges Adams.

Other things being equal, the happiest people are they who possess the most abundant supply of the most wholesome food from the land which surrounds them, so as to insure against scarcity. This condition supposes a surplus of food, and not a merely exact supply. Abundance, to permit of some waste, is essential; and though the axiom "Waste not, want not," be a sound one, there are numerous contingencies which make it desirable to waste some surplus of human labour on a surplus of food to throw away, rather than to calculate too closely, without margin. It is true "that increase of appetite doth grow by what it feeds on," if the table for one hundred be supplied with food for ninety and nine, while the contrary will be the case if the food be sufficient for a hundred and one. We have the apparent anomaly of constant waste and destruction of food in the processes of imperfect distribution, while there is a fringe of starving people constantly existing on the edges of society; but the true remedy for it is not by putting everyone into a condition of anxious calculation of quantities; the true plan is to ensure a larger surplus.

Malthus tells us that there is a constant pressure of population against the means of subsistence, which is only saying, in other words, that pleasures are instinctive, while work is a result of moral and physical economy. As moral training improves, the pressure will become less by the multiplication of food, and the lessening of the drudgery of procuring it. Wherever life prevails, either in animals or vegetables, nature has provided for an enormous surplus of births, to compensate for destruction. The mustard plant would cover the whole earth, were there no animals to devour it, no competitive plant to disturb it. Thus the weakest perish under nature's law, being destroyed by the strongest, and thus the strongest and hardiest, both of plants and animals, are kept up to perpetuate the species.

Wherever unintelligent uncultivated man prowls, he follows this law in common with the lower animals. Red Indians, in tribes, finding food scarce by the too great destruction of wild animals, massacre each other, the strongest prevailing, and by the lessening of their numbers, the deer and bisons again increase. This is the condition of the universal law of prey, under which lions and tigers live—spontaneous food.

Intelligent, cultivated man no less obeys the law of nature, but in a different mode. By artificial increase in the quantity of food, he prevents competition, and abrogates the law of prey. The surface of the earth is practically multiplied by human skill, in proportion as the human understanding is cultivated, and the time will doubtless arrive when contingencies of all kinds will be provided against.

During years of travel, my attention was much awakened to the results on humanity of various kinds of food, and the modes of procuring it. We all know what Ireland has been like, with its one universal diet of potatoes, and the emigration consequent on their failure, as well as the perennial starvation, and self-imposed poor law under the name of hospitality. Amongst the French *habitans* of Canada, a similar condition of things prevailed, possibly prevails still, though not confined to potatoes. The cultivators of the soil, living apart from markets, produced in the summer provisions to store up for the winter. If their calculations were incorrect, starvation occasionally overtook whole families, who died before the return of the crop season. Vegetable-fed, gentle, and suffering patiently, they passed away.

On the Pampas of Buenos Ayres, a lank, lithe, wire-haired, dark-looking, black-eyed race of men ride constantly on horseback, and feed on the flesh of animals of various kinds, but chiefly beef, which is roasted with the hot blood in it by fires of dried dung. If allowed to get cold, it becomes tough. Horses, mules, and deer have a sweet flavour when eaten fresh; and as there is no provision of safes to keep meat from flies and vermin, beef is preferred as the best flavoured in its fresh condition, albeit stringy. Of this food a man will devour at a squatting four or more pounds, without salt or vegetable. Grass being abundant and men scarce, the cattle increase and multiply to an enormous extent, as there are scarcely any wild animals to prey on them other than wild men. But at intervals of from four to five years, there occurs a drought, the grass disappears, and the neighbourhood of the dried-up streams becomes a cattle Golgotha, and the land is thus largely manured for the advent of the ensuing rain. Nature deals in compensations.

In Chilé meat is a luxury of the wealthy, and those who labour feed on dried beans and bread when they can get it. Small tenants, or farmers, renting pieces of land—for Chilé is owned by a landocracy—store up their scanty crops, potatoes, pumpkins, beans, red pepper, and onions, for winter use, with wheat if they can, though it is generally sold on the ground to those who are in the blessed condition of possessing granaries, after the due deduction for those who lend the oxen to plough the soil. In years long past, one shilling per bushel was the value for wheat on the ground before reaping, rising to two shillings after reaping, and four shillings in the mid-interval between season and season. One particular year, known as the year of the flood, on account of heavy rain at intervals, the crops, usually grown by means of irrigation, failed by blight, and the price rose to six shillings. The poor people, and perhaps the rich also, unaccustomed to this, sold all their best wheat, and saved the worst for seed. The result was, that in the following year, the price rose to twenty shillings, and in the garden of the Pacific, that was wont to supply all Peru with breadstuffs, large numbers of people were reduced to live on wild herbage and seaweed, many of them perishing. And then, for the first time, barrelled flour was received round Cape Horn from the United States, to feed a nation following the occupation of food producers.

In Chilé people pray for snow, and not for rain. If the deep clefts of the Cordilleras be stored with snow in the June winter, they are sure of full rivers in the summer, and, by means of irrigation, they have full crops. Even sand is made to produce when water can be made to reach it. The lowest level valleys are the choice lands—*tierras di riego*—but the mountain hill slopes, bathed by the moist winds of the Pacific, are also fruitful. Bountiful, also, are some of the slopes and plains on the eastern side of the Andes, where irrigation is brought to bear, as the corn, wine, and oil of Mendoza and San Juan can testify, but the hot Sonda wind, the American simoom, and the plague of locusts are there to defeat man's work, and cover the emerald oasis with the barest brown. "What bird is this?" I asked of my guide, when the first locust struck me, a stranger, in the face. "A bird of bad omen, Senor!" was his reply, in a strain of oriental diction, "the leader of those birds who will leave us no bread to eat," and so it was. They came on and on, a hideous brown cloud, shading the sun, with horn-sheathed eyes and cutting forceps, that left the trees leafless and the ground bare.

In that dry land were two methods of making granaries. One was to dig a hole in the soil, under cut-line it with stones, fill it with wheat, and cover it up, thus converting one-third into a fermented and caking crust that held the remainder in good preservation. Another method was to take off the skin of an ox entire, extracting carcase and bones through the orifice of the neck, then hanging it between four posts and filling it with earth till the hide, very distended, expanded to twice its former size, and then dried to the condition of thick parchment, when the earth was taken out and replaced by wheat. A row of these bloated skins, standing side by side in order, with the horns suspended just above the ground, presented a strong resemblance to a file of Assyrian stone bulls, headless by age.

On the heights of Potosi, where the far-famed conical silver mountain is pierced on all sides like a honeycomb, there is no soil to grow vegetation, and upon troops of mules and flocks of llamas the food of 80,000 human beings is brought into the mud-built city. Rich soil is conveyed in pots to the interior of the dwellings, and green herbs of savour are grown, that a sprig from time to time may be used to flavour the broth. There, also, the art of economising fuel prevails, by burning it in a horizontal flue, pierced in the upper surface with round holes, into which are fitted the earthen cooking utensils.

Maize, meal, potatoes, and animal fat, are concocted into many kinds of edibles, and old women in a circle chew maize grains to a fermentable condition to manu- or, rather, mouth-facture maize wort into an execrable beer.

"In the sweat of thy brow shalt thou eat bread," is well verified on the spots from which the grain is brought. I have seen a team at work in which a cow was tied to the plough—a veritable old Roman implement—a mule to the cow and an ass to the mule, and a woman, with the leading cord over her shoulder, adding her physical strength to the whole, while her husband held the single stilt. And I have seen a score of women spinning cotton at the edge of a mountain lake, each with her wheel driven by a spirt of water to spin a single thread, the principle of the cotton mill and spinning jenny not developed; and I have seen Patagonian women, with a loom formed of pegs stuck in the bare earth open to the sky, on their knees plying the shuttle to form a poncho of the brightest of wool, dyed and spun by themselves, and capable of turning any amount of rain water better than the best woof of Leeds or Manchester; and I have seen the Chilé gold crushing mills at work, made of native wood and native granite, with not five pounds weight of iron in their whole composition, extracting gold more effectually than by all the powers hitherto used by more civilised people.

Frequent hunger, sometimes very like starvation, stirred deep thought in me on the question of food-producing and food-preserving. The difference between gardening and field culture in result was obvious, but that whole difference was produced by human labour. I remarked a very great difference between land cultivated by irrigation, both in labour and produce, saving the one and increasing the other. Irrigation drew too much fertility out of the upper soil into the lower. The sun also was a main element. I know by experience the difference in nutritious effect produced by the flesh of tired cattle on a march, and those slain in a condition arising from abundant food and healthy exercise. In the former case any amount might be eaten without the satisfaction of hunger, while, in the latter case, a smaller amount removed hunger. But I discovered, also, that certain other food of a different quality, such as grape syrup and fruit could help the tired meat to assimilate, and thus to remove hunger. But not till long after, when I had read Liebig's remarkable experiments, did I know the chemical reasons. Travelling is not favourable to chemical research. I knew that heat and water were essentials in growth, but how they operated I knew not.

When first I saw the steam coach of Walter Hancock traversing the New-road, my mind went beyond the mere vehicle of transit. I saw the power that moved the cotton and silk mill made locomotive, and I beheld the elements of agricultural labour thereon transferred from man to steam. The how was in the future.

It appeared to me, as it does now, that one of the first principles in producing vegetable food should be to change their structure as we do that of animals, to get rid as much as possible of the mere water, and replace it with oily and nitrogenous substance. When gardeners shall have bestowed as much pains on the conversion of food vegetables as they have done on flowers and fruits, we shall probably attain to more startling results.

Our vegetable root and seed crops grow in the summer and cease to grow in the winter. The difference obviously exists in the presence or absence of the sun, for unexpected sun in winter causes the buds to put forth; artificial heat in hothouses or greenhouses does the same thing; and, in parts of Saxony, where coal mines are on fire a considerable depth underground, the snow never lies, and the grass is green the whole year round. If we could have the coal-pits alight underground in England we should soon turn them to account in the growth of better things than grass, and carry off the produce by railway.

The truth is that plants, like human beings, like to have their feet warm and their heads cool. Gardeners will tell us long stories about "bottom heat" in greenhouses, but they never think about it in the open air. Vines and other deep-rooted plants will push out their roots in search of steam pipes or other underground heat for long distances, just as fish will congregate in the neighbourhood of tepid water where food is found. It is probable that the stimulus of ammonia to plants is analogous to that of heat, but the ammonia and other kinds of manure exhibited on the surface of the ground seem to be very wastefully dealt with. They ascend into the atmosphere instead of descending into the soil.

We require, then, to deposit both heat and manure under the soil, where the roots of the plants may find and appropriate them, instead of upon the soil where they escape. By the combustion of coal we get both heat and ammonia, and there seems to be no reason why we should not distribute the products of combustion underground in such chemical arrangement as to prevent mischief and attain useful results. The refuse of the gas works is gradually converting into manure. Why should we not put it underground direct, and—plus the heat so useful in cultivation. Why not put heat underground in the form of steam or hot water, combined with charcoal manure. The heat deposited could not be wasted. It could only escape by ascending to the surface, and thus warming the whole soil. The liquid manure, spread on the surface, is wasteful to begin with, and has also the effect of making the surface into a solid plaster, impeding the action of the atmosphere.

Supposing this to be capable of mechanical accomplishment, the question will be "Will it pay?"

No; it will not pay if it be done in a remote corner without means of efficient transit, but if it be produced within easy distances of large towns, with a cheap railway running direct from the crops to the market, there can be no doubt of its paying a higher profit then has ever yet been achieved upon land. The growth of root crops and leaf crops, though not of seed crops, can be prolonged for a far greater period throughout the year, into the months when the sun does not shine; and the consumption is almost unlimited. As yet green vegetables have been, for the most part, a luxury confined to the rich and easy classes. Every class would consume them in large quantities could they only get them within reach of their means. A cheap railway, with a growing ground at one end and the actual city market at the other, are the simple means.

All things considered, the heaviest crops are produced upon lands where rain rarely falls, but where an abundant supply of water exists for the purpose of artificial irrigation. Certain plants grow best in swamps according to our present practice, but it does not follow that they would not grow better with a plentiful supply of running instead of stagnant water. In Great Britain for years past a chief object in agriculture has been to drain the land, *i.e.*, to clear away all the natural reservoirs for water, reservoirs provided by nature during man's mental minority. Our climate is thus bettered and bettering, and the time will come when this constant drainage will leave the land too dry, and we shall have to resort to artificial reservoirs to retain in larger bodies the water which now reaches the sea in but a few hours after a rainfall, and to use that water for irrigation purposes in better modes than are practised in the hot lands of the tropics, and in our own "water meadows." The practice of irrigation in the East can scarcely be called artificial, inasmuch as the water is merely let at intervals down natural slopes of the earth's surface. Pure artificial irrigation would be to convey water and manure not on to the surface, but beneath the surface of either level or sloping land without artificial channels on the surface, and without converting the soil into a crust.

The first conditions, then, of the artificial culture of vegetables are,—facility of removing surplus moisture from the soil; facility of artificially heating the soil by bottom heat; facility of giving bottom moisture to the soil; facility of giving bottom manure to the soil.

These conditions are recognised in hothouses and greenhouses with patches of a few yards of earth, but with the disadvantages of imperfect aeration of the leaves of the plants, and consequently a comparatively unhealthy crop. With bottom heat below the ground cold and damp would be tempered to a sufficient height above the ground, and any amount of acreage could be brought into a condition of continuous crops.

Drainage for the discharge of surplus water from land is well understood, but the application of the same pipes for the irrigation of land does not seem to be understood at all. The cheapest source of heat that we at present know of is coal. To burn coal in a close furnace, and to discharge the products of combustion into a congeries of pipes four feet beneath the soil, does not seem a problem of difficult solution. If draught be difficult, a fan or blower at the exit would ensure the circulation. Whether the simple products of combustion would be noxious or not to the plants after filtering through the earth, must be a matter of experiment. If they proved noxious, it would be for the chemist to make a neutralising admixture. Whether the injection of steam with gaseous manure combined would be better, remains also a matter for experiment. One thing is certain, that the greater part of product refuse of the gas works is convertible into manure, and that its cost is enhanced by double transit. With the coal carried direct on to the farm, and the distribution of the heat and gaseous manure without any cost of men or animals, the economy ought to be very great indeed.

Meanwhile the experiments for crossing and feeding vegetables, as we now cross and feed animals, and as we cross and feed flowers, should be made the subject of deep and wide experimental research. No cheapening of labour is essential for this object.

I now come to consider the great, the paramount question of all—how to extinguish animal labour and reduce the physical drudgery of farm labourers to the healthy exercise of intelligent and cultivated men. Upon the thorough solution of this question depends the extinction of slavery, whether black or white, throughout the world. Issachar shall no longer be a strong ass between two burthens. Coolies or Chinese shall no longer be hired out as farm cattle, nor shall the African be longer kidnapped and sold for a working ox, with his life shortened by excessive work in the service of those political economists in cotton and sugar who deem that it is better to buy than breed.

Connected with railways for a long period, one of my principles was that the hard iron surface, which diminished friction and economised labour in transit, must be still more suitable in the process of working the land, where both transit and labour were requisite. In the year 1845 I wrote an article in the *Westminster Review*, propounding the theory of rails on cultivated land for the purpose of supplying steam power, then supposing stationary power:—

> "In farm districts the power need only be applied to road purposes when required, using it for farm purposes at all other times.
>
> "In sober earnestness we propose to convey artificial heat beneath the earth on open land, so as to maintain the temperature suited to the growth and development of the vegetable tribes by means of pipes of metal or earthenware circulating steam or hot water or air from a close boiler or stove. These pipes to be laid at depths of four to five feet in the manner of deep draining. Also by a similar process to inject the ground with gaseous manure, as ammonia and carbon, so that the heat and gases may be constantly ascending towards the surface, and thus be absorbed by the roots of the plants.
>
> "We shall yet see the time when rails will be laid along the surfaces of our fields, whereon cylinder harrows will traverse, driven by the same stationary power, to break the soil into fragments fit for the growth of plants.
>
> "When our land shall be drained, dried, moistened, heated, cooled, and injected with liquid and gaseous manures at pleasure, and, moreover, cultivated by power machines, we may be truly said to have conquered the earth, or a portion of it."

Nothing practical that I am aware of came of this, though sundry "improvers" and projectors pronounced the idea "ingenious." Still, the ideas of heat and manure *injection*, in opposition to surface applications and the application of rails and steam-power, remained in my mind a conviction, though not demonstrated publicly, to which I recurred from time to time in publications, other pursuits rendering it difficult for me to aim at practice. Early in 1850 I published a work called "Road Progress," advocating the amalgamation of railways and highways for agricultural improvement and steam farming in Great Britain and the Colonies. The following is an extract :—

> "From the towns the parish roads diverge, and rails laid on them might be carried direct into the farmyard. Here, then, we have the produce at one end of the line, and the metropolis or other town at the other end. . . . . From this farmyard lines of moveable rails would be found well adapted to take the dunging and manure by horse-trucks to the centre of each field; or a farm locomotive might be established thereon, a proposition not for ploughing, but for doing the same kind of work better by harrowing, or it might be used to pump water up to drain away, or to pour over the fields in irrigation, or to inject manure or heat, or both combined, beneath the surface of the land for the sake of improved produce. With a small portable saw-bench and morticing machine, ready to connect to the engine, the farmer might, with the rude skill of his own farm-labourers construct from time to time all the wood work he might require, as is the common practice amongst farmers in the United States.
>
> "It is difficult to estimate the importance of carrying coals by rails direct into the farm. From that time the farm will take rank with the factory in labour-saving processes, and the production of food will be so cheapened as to put to rest for ever the fear of foreign competition. Without cheap coal, farm operations can but be very imperfect."

My next attempt at agitating this question of railways into farms with steam culture was, if I recollect, in a paper read before the Society of Arts in December, 1850.

> "Siding rails would run into farm-yards, and the markets would be at the stations and termini. Coals being thus borne cheaply on to the farm, farm machinery would rapidly increase, and farm labourers would acquire mechanical skill. Temporary rails would become a farm utensil, as they now are in the hands of road contractors, and contrivances innumerable would be the result. * * And not mere grain and meat would be produced on the farms, but the heavy class of vegetables, so important as human food, but which hitherto no town has possessed up to the extent of its consuming power. * * The power of the locomotive might also be applied to inject land with steam heat and gaseous manure through the system of drain-pipes.
>
> "There is yet needing an influential landholder to be the agricultural railway-maker—what a Bridgewater was to the canal-maker, and a Devonshire has been to the horticulturist—to multiply manifold his own revenue, while being the world's benefactor."

In 1851, in an article in the *Westminster Review*, on the Industrial Exhibition, I again agitated the question :—

> "Unless the rails so laid on occupation roads shall have one terminus in the farm-yard and the other in the market, either directly or in communication with main lines of railway, the maximum of cheap transit for produce will not be attained. When this shall be done, and it will probably be by the agency of rails inserted in the surface of ordinary highways, the costly and artificial labour of the farmer in shifting his loads will cease, and the saving will become perfect.
>
> "But there is more than this, to which we have called public attention before. There needs a system of rails for transit on the farms. Time will show that permanent ways, as well as moveable, will be needed; but permanent way means a new laying-out of the farms in rectangles, to which the system of steam-digging may be applied—not steam-ploughing, for ploughing is a process that never would have been invented had not horses and oxen been invented first. We do not plough with man-power, neither can we with steam-power to advantage."

After the Great Exhibition I was not one amongst those disposed to scoff at the "agricultural mind." Considering their isolation from the hands of thickly congregated men in cities, the wonder really was how much the farmers had accomplished, and not how little. Considering that working farmers possessed but small capital, and mostly short leases and no freeholds, it was not wonderful that they did not dream of bringing the machinery of a cotton mill on to the land, and those who possessed the capital, the landlords, had little belief in steam. Lord Willoughby D'Eresby did try to turn a locomotive to account by a system of ropes, but this was a failure, and most plans since have had reference to drawing ploughs by ropes. The practicability of using an engine bearing on the soil to dig by steam power and propel itself has been much mooted, but till the advent of Boydell's engine it was an impracticability, and of questionable advantage even with that. My own view of the process of earth working was thus expressed in the article on the International Exhibition :—

> "For heavy land there needs a revolving engine, made to cut with the sides, with an advancing movement, precisely as grooves are cut by machinery in wood. When there is hard work to do, circular movement is the only method, whether for wood-carving, metal-turning, timber-sawing, or earth-cutting,

and we are not sure that a series of vertical drills on a large scale, of the size of spades, cutting the whole surface to a sufficient depth, and travelling forwards at the same time, would not be the most efficient mode of ploughing. We incline to think that the time will come when ploughing and drilling, sowing and harrowing, will all be performed at a single operation, like paper-making. It is but getting together a mass of earth spinning-jennies, of stronger construction than those used for cotton and flax. The only impediment is too much moisture, but this may always be avoided by sufficient drainage. * * We apprehend that it will be in the North—in Lancashire and Yorkshire—that the first strides will be made towards obtaining the real possession of the earth for the purposes of agriculture."

Thoroughly convinced of the practicability of such a system of cultivation by steam machinery combined with rails, I had purposed, amongst other projects, to give my imaginations practical effect, or rather to combine existing practice into a whole, whenever leisure might obtain. It was, therefore, with no small pleasure that I listened to the paper read by Mr. P. A. Halkett before the Society of Arts, on the 8th of December last, on "Guideway Agriculture, being a system enabling all the operations of the farm to be performed by steam power." It was not left for Lancashire or Yorkshire to do this thing, but to Peter Alexander Halkett, of the Windham Club, St. James's, in our own London, and I understand a naval officer to boot, and not an agriculturist, showing that now, as often before, improvements come from outsiders looking on, rather than from regular practitioners.

To any competent mechanic the diagrams would have sufficed without the paper, but on the following day I visited Mr. Halkett's machinery at Kensington, and found in Mr. Grafton a most intelligent and practical exponent of the whole system, which in general terms amounts to this:—

The travelling platform frame of the builder, such as we see at the Houses of Parliament and Westminster Bridge, and at Portland and Holyhead, moving by man power on rails, on the tops of high scaffolds, is enlarged in width and breadth, and placed on rails on the surface of the land to be cultivated, raised to such a height as to clear the plants, and instead of man power is moved by engine power, which also serves to put in operation the various tools required for dealing with the land. The tramway frame of the builder is thus practically married to the portable engine of the farmer, and is furnished with tools from the workshop of the engineer. The mill that cuts iron like cheese has ceased to be a fixture, and is made moveable over the face of the land, to cut and carve the soil into fragments, to rake it into fine mould, to free it from weeds, and clean it from stones if needed. This, at Kensington, is the practical germ of the process that will multiply four-fold the farmer's crops, that will convert the farm labourer from an ill-clad uncultivated human being, into a well-clad intelligent mechanic, working under covered shelter from the sun and rain, and with all the advantages of fresh air for his workshop, that will enable this intelligent mechanic to work on a sugar or cotton plantation with a steam fan if needed, keeping his body constantly cool; that will give to the white man the practical dominion over tropical labour he thinks now only attainable by the negro; that will make as great a revolution for humanity as was done by the advent of railroads, which destroyed the practice of cruelty in overdriving post-horses; that will render the night equally available with the day for all the processes of cultivation. The plough, the harrow, and the hoe, the rake, and the dibble, broad-cast, and drill sowing, may all be set in motion by steam, and hoeing between rows of wheat may at last be accomplished.

For the purpose of depositing liquid manure at the roots of the plants instead of on the surface, Mr. Halkett has constructed a tool in imitation of the tooth of the poisonous serpent or the sting of the wasp. The liquid exudes through the end of the pipe which cuts the trench below the surface. But there is yet a very important tool that requires adding, a vertical drill with cutting edges, which, as it advances, will comminute and aerate the soil between rows of plants, and produce a far better result than the man hoe.

The tank carried on the platform will be very available for liquid manure, but for the purposes of general irrigation a new method is desirable, as it would be impossible to carry sufficient water on wheels. Perforated pipes of earthenware should be deposited at two feet depth below the surface, provided with entrance for the water but no exit. These pipes being filled from the nearest level, the water will be absorbed by the spongy superincumbent soil, and carried to the plants without caking the surface. This is a most important process, for it will render level uplands more valuable than the low-lying lands called meadows, usually selected for market gardens, as Greenwich and Deptford.

An arrangement of this kind would be peculiarly adapted for hot climates, were it only to save water. The valley of Valencia, in Spain, is a large triangular plain, sloping to the Mediterranean, between two lofty mountain ranges, which unite where the river rushes down. This river, the Guadalquiver, would be, in the warm season, wholly absorbed for the purposes of useful irrigation, but, probably, one-third of it is evaporated by the sun, and another third wasted on surface weeds, and the scarcity of water is so great that perennially faction fights occur amongst the peasantry quarrelling for water, which have to be put down by the soldiery, and though scarcely a drop reaches the sea, large quantities of fine land lie waste.

On this system of cultivation by machinery it is obvious that a straight surface of soil is the best, and that a level surface will involve less power than an incline. It is obvious, also, that the longer the run of the machine the more convenient will be the operation and the less the cost of rails, as there will be less proportional amount of heading, and, doubtless, as the system goes on, levelling of the soil will take place, as on roads, to facilitate draught. Other things being equal, the level surface will be worked at less cost than the incline, as is the case when horses are used.

I now come to the question of the rails and machinery as set out by Mr. Halkett.

To work a railway economically with the least consumption of fuel, it is essential that the rails should not deflect either vertically or horizontally. The greater the pressure the stiffer the rail must be, and the shorter the length over which that pressure extends the greater must be the strength of the rail. If traction be performed by the adhesion of driving wheels, the greater the number of driving wheels with a given load the more the pressure will be distributed, and the lighter may be the rail. As the cost of the rail is proportionately greater than that of the machine, Mr. Halkett prefers to use light rails and a large number of driving wheels.

On an ordinary line of railway the wheels have a single flange in the inside, and the peripheries are in the form of cones and not of cylinders. The object of this is to compensate for curves on the rails. The result is a great pressure, tending to force the rails out and widen the gauge. For this reason strong cross ties are essential to hold the rails together. For the purpose of cultivation these cross ties are inadmissible, and therefore the wheels of the machine must be made cylindrical and with two flanges. In this mode there will be no tendency to vary the width of the gauge.

In using a single pair of driving wheels for the purpose of propelling in a straight line, there should be no rubbing friction, provided the wheels are exactly of the same diameter. And whatever is the number of the driving wheels, the exactness must exist both in the peripheries and in the crank pins and connecting rods, or in the connecting chains if chains be used. It becomes, therefore, a question between stiff rails and few drivers, or light rails and many drivers, as to cost. If cast wheels be used not turned to exactness in the lathe, some compensation must be provided to prevent the rubbing of the tyres on the rails, which would soon destroy both. Mr. Halkett, dealing at present with very flexible rails, which can securely be permanent, does not sufficiently estimate the amount of this difficulty which will occur when solid machines and sufficiently firm rails are used. Moreover, if stiffness be not provided in the rails, it must be in the frame. A flexible frame would not distribute the load, but would suffer every wheel to sink into the successive hollows.

The rail Mr. Halkett has chosen—a light angle-iron, is the worst form for strength that can be contrived, unless we suppose it to be firmly fastened down to a solid base. I have used such rails for light purposes in machinery, but it is a serious objection that they deflect vertically and widen laterally, decreasing their vertical strength rapidly as their load increases. If with a given weight of metal Mr. Halkett does not find his rail deflect, it will simply prove that he is using iron in waste.

The system is made to depend, not on the strength of the rail itself, but on a substructure of burnt clay or concrete 15 inches wide. The cost is stated at £20 per acre, leaving a serious nuisance on the ground, if at any time the course of the rails need to be changed. There is no need whatever for this substructure, for at the same cost a self-contained rail of great strength can be applied on the surface in such a mode that it can be taken away without any waste and removed to another position when required. If a rail be used so weak as to depend on substructure, there will need a constant patching and mending. If a stiff rail be used, the ordinary surface will be sufficient.

The frame, pair of engines and tools, are estimated to weigh about 24 tons, on twenty-four wheels, or a ton per wheel. As this weight is all adhesive or propelling, it will be equivalent to six tons of traction force, supposing no undue friction. If cylinders of 6 inches diameter be used with a 4 feet wheel and sixteen inches stroke of piston, the locomotives will give out about 2,500 lbs. at the periphery of the wheel, and as little more than 250 lbs. will be needed for the purpose of propulsion at 13 lbs. per ton, 2,250 lbs. will be left to work the machinery at a speed of 10 miles per hour.

But if instead of a level there be an incline of one in 100, the resistance to traction will absorb about 740 lbs.; on an incline of one in 25, about 2312 lbs., nearly the whole force.

If the driving-wheels be worked at a slower speed, with a toothed pinion at the periphery, there will of course be more available power for the machinery.

The system of Mr. Halkett, in making a double engine for an enormously wide gauge by a connecting beam, thus keeping the chief load direct on the rails, displays great ingenuity, but whether the multiplicity of driving wheels in connection with it for the sake of a light rail, will prove the best system remains yet to be seen, and it would be quite worth while to try the plan of Mr. Boydell with a similar structure.

There is little doubt that a gauge of 60 feet may be worked on this system, which will only require 250 yards of rail per acre including headings, calculating a farm of a square mile, or 640 acres, at a cost of £20 per acre, or £12,800 per mile. The machine may be estimated at £2,000, making a total of £14,800, which for interest and materials will be £3 annual per acre. But the machine will go over the whole mile in 44 hours, say three times in a week, so that four square miles may be estimated to one machine. Reflecting that the rails of four square miles, or 2,560 acres, only weigh 5,000 tons, and the machine 25 tons—total weight 5,025 tons, and total cost £53,200, and total annual interest and material £6,384, it does not seem a matter beyond the reach of a company of tenant farmers with a moderately long lease, inasmuch as they can carry off the whole of the materials at the end of the lease, and the more especially with the probability of a double crop off the same extent of ground at half the cost of labour.

If this manifestly practical plan, doubling the strength and power of the English nation, be suffered to lie in abeyance, it will be a standing satire upon the agricultural bodies ranking amongst them the oldest traditional names of our country.

NEW PAPER MATERIALS.

By M. C. Cooke.

One result may fairly be attributed to the offer of a premium, by one of the daily papers, for a new and available paper-stuff, which should supply the deficiency of rags; and that result an important one. It has stimulated many an effort to supply that want not only at home but abroad; and we are now in a much better position to do without rags for our own paper manufacture than at any other period of our history. It may be true that the premium has never been paid, but it is equally true that we are nationally full the thousand pounds richer on account of that offer. Why it has not been paid, forms no part of this inquiry, neither to whom it should have been awarded. Let it suffice to point to some of its results. Out of the numerous efforts to furnish good paper with only a per centage of rags, one of the most successful with which I am acquainted is that of Dr. Collyer, which was patented in 1857. It consists in applying the residue of the beet-root left in the process of sugar making and distillation to the manufacture of paper, papier maché, millboard, and other paper manufactures. One feature pointed out in the process of this manufacture is, that no sizing is necessary, on account of the nature of the material used. In consequence of the whole mass being permeated, instead of the surface alone being covered, it is, from its compactness, solidity, and elasticity, not liable to crack, and for the same reason will resist damp and moisture when in the form of paper. The patentee states, "The extraordinary tendency which the cellulose, starchy, and proteine substances have to enlarge when exposed to heat and moisture, renders them very valuable for giving strength to other material, especially to cotton, which is deficient in these properties. When thus mixed each fibre of the cotton becomes cylindrical and thick, and attains the strength of hemp and flax, and no longer loses its shape through pressure. A similar improvement is evident when it is combined with other materials. A proportion of 10 per cent. of the prepared residue with the other usual material, makes tougher and more flexible paper. Twenty-five per cent. renders packing paper sufficiently waterproof that it will require no other sizing. Fifty per cent. will produce paper nearly or quite as strong as parchment, and which in very thin sheets will preserve articles packed in it from dampness. Strong paper, cardboard, &c., can be made from 75 per cent. of prepared residue and 25 per cent. of cotton; also of 50 per cent. of prepared residue 40 per cent. of raw residue, and 10 per cent. of sawdust, hay, straw, &c. Fifty per cent. of prepared residue and 50 per cent. of fine cut straw will produce strong packing paper, as will also 50 per cent. of white sawdust, 30 per cent. of prepared residue, and 20 per cent. of cotton rags. A good, strong, white paper for printing purposes has been made with 50 per cent. of beet-root residue and 50 per cent. of cotton, no sizing being required in the process, and the result has been entirely satisfactory, the paper so made being remarkable for its tenacity. It will, however, have been observed that something beside the beet-root residue is required to make good paper, and that the best substance for that addition is cotton or cotton rags, the use of which this patent does not supersede."

Another patent, or rather series of patented paper pulps, worthy of notice, are those of Mr. Plunkett, of Dublin,* in all of which the material, *per se*, is capable of furnishing serviceable paper. Patented also in 1857, the entire value and capabilities of the materials have not yet been fully ascertained. Mr. Plunkett's papers are made from four different plants, any one of which furnishes a good paper pulp, and may be obtained in almost unlimited quantities. These are the tree mallow, red clover, hop bine, and yellow water-iris. To the first of these we may look, perhaps, for the most satisfactory results. The order to which the tree-mallow belongs is composed of eminently fibre-producing plants. Independent of the cottons, we have numerous species of *Hibiscus*, *Sida*, *Abutilon*, *Urena*, and *Thespesia*, yielding useful fibres, which leads us to expect, perhaps, to find in *Lavatera arborea* a good material for pulp.

"The tree-mallow grows wild on several parts of the south-west coast of Britain, as well as on the east coast of Scotland, on rocky cliffs, flowering in July, and often producing a long succession of bloom. In gardens the plant often remains some years without blossoming, but dies in the winter after it has flowered, being naturally biennial. Seeds scattered in the ground will some of them keep springing up every season for an undetermined number of years, but the young plants are impatient of the cold, except in maritime situations, and few of them survive even a single winter. The root is deep and much branched; stem, 6 to 10 feet high, upright, straight, round, simple, except in the upper part, where it forms a branched leafy head. It is clothed with clusters of small deflexed bristles. Leaves alternate on long stalks, pliable and downy, of seven shallow crenate lobes. Flower on simple axillary clustered stalks, very much like those of *Malva sylvestris*. Outer calyx deeply divided into three large lobes, but not as in Malva formed of three separate leaves. A slight or rather artificial distinction."†

On inquiry, I find that the *Lavatera* will, with the addition of saline manure, grow freely on the deepest bog land. My informant states that he has seen it in perfection on the west coast of Donegal, growing where there was very deep bog, at least thirty feet. A gentleman in Londonderry, who is owner of a large tract of slob land, intends cultivating the plant extensively next season, for which purpose he has about 250 acres at disposal. When this experiment shall have been made, we shall be in possession of facts as to the cost of culture and the produce per acre. The plant, if cultivated, would not only yield hemp enough for home use, but also give, from the hacklings, or tow, and the wood, a large supply of paper material. The quality of the hemp obtained from the bark would command for it a ready sale. Cordage has been made from it experimentally, and so satisfied were the company entrusted with the manufacture of the specimens, that they have guaranteed the purchase of any quantity which may be grown on the Londonderry estate next season. The refuse leaves, wood, and tow, would furnish paper pulp.

The process of manufacture of paper from these substances is that ordinarily pursued. The wood has to be reduced to chips or shavings, and, whether wood, leaves, or tow, boiled in caustic alkali, and bleached in the ordinary manner. The paper thus made presents no external variation from that made of rags.

Specimens of the plant, wood, hemp, cordage, fine thread, and lace, made from this plant, together with paper made from the wood, I shall be happy to show to anyone interested in the experiment.

Another substance used by Mr. Plunkett for paper pulp is the common red clover, *Trifolium pratense*, in order to obtain which the clover is taken, either in its green state or when dried into hay, and first submitted to a rippling process, by means of which the leaves and blossoms or seeds are saved as fodder for cattle. The stalks are then submitted to the action of caustic alkali, bleached, and pulped in the usual manner. Paper and cardboard produced from this pulp is also of a firm and excellent quality.

A third material is subjected by the same gentleman to a similar process with a like result. This substance is the hop bine, or twining stems of the *Humulus lupulus*, a material which, in many parts of the country, may be obtained in almost any quantity, and which has been hitherto regarded rather as a nuisance than as a stock to be converted into a valuable article of trade. Instead of being, as heretofore, burnt up for manure, Mr. Plunkett has shown that it may be converted into a useful paper, the dried bine yielding from 70 to 75 per cent. of fibrous matter.

The fourth and last of Mr. Plunkett's papers is made from the leaves of the yellow water-iris (*Iris pseudacorus*), which is not only a very common weed in Ireland, but is also common enough in the marshy parts of England. It yields, when dry, about 60 per cent. of available fibre or half-stuff, and, as far as one can judge from unsized specimens made by hand, will make a paper equal to that produced from either of the other sources.

Hence it will be seen that the Irish patents in each instance offer a material, not to be used in conjunction with rags or other fibre, but independently, as substitutes for those substances. In each case the raw material is either common enough, or, as in the instance of the Lavatera, may be easily cultivated on waste lands in sufficient quantities to supply all our wants; and, beyond this, to furnish us with a fibre for cordage and textile manufactures of a new but valuable kind at home, instead of seeking supplies from Russia and India.*

Independently of "substitutes for paper material" at home, and of the premium before alluded to, the reports of the Paris Universal Exhibition contain an interesting account of a paper material now in course of manufacture by a company established at Florence, from the common asphodel (*Asphodelus ramosus*). The roots are first made to undergo a process of distillation, during which alcohol is obtained, and the residuum, together with the other parts of the plant, is converted into card paper, cards and paper, including writing papers of various qualities. The gum which abounds in the asphodel is a highly advantageous ingredient; it gives gloss to cardboard, and prevents writing paper from becoming absorbent. The stoutest cartridge paper which is made from this plant is found to bend without breaking, and is not apt to tear. Corsica, Spain, Algeria, Portugal, all have hastened to follow the example of Tuscany, and to seek to derive advantage from the asphodel, either as yielding alcohol or paper-stuff, or both. If even the enormous tracts which are covered with asphodel should in time be exhausted, the culture of the plant is by no means difficult. The manager of the Grand Duke's domain, at Alberese, offered, a few years ago, 40,000 francs for the extirpation of the asphodel, in a comparatively limited territory, and no person was found to undertake the next-to-impossible task. It is stated, moreover, that the asphodel produces alcohol and paper, at a much cheaper rate than any other material which has yet been tested, and there is good reason to hope that it may yet prove a providential benefit to many sterile and unproductive districts.

From North America, I have just received a series of specimens of what our brethren are doing on the other side of the Atlantic in paper stuffs. This series contains white pulps, made from white pine, yellow pine, white cedar, red cedar, hemlock spruce, white oak, maple, gum, chestnut, ash, bass, sycamore, birch, catalpa, beech, willow, paper mulberry, mulberry bark, black walnut, elm, tulip poplar, hickory, straw, reed, maize, and sunflower. The American straw papers seem to possess tenacity and quality superior to those of British manufacture. To what extent these wood papers are made and used in America, I have as yet received no information, the promised papers and particulars not having come to hand.

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* Specimens of these substances were shown at the Society's last Annual Exhibition of Inventions. See Catalogue for 1858, No. 301.—Ed. *J. S. A.*

† English Botany, or Coloured Figures of British Plants. London, 1803.

* The last patented paper material is that of Mr. Haughton, for converting the refuse of flax straw into pulp. The process consists of an application of an alkali, in a heat of nearly 400 deg. Three tons of flax refuse, at from 20s. to 50s. per ton, can, it appears, be converted into one ton of pulp. The rags for the same amount of pulp would weigh one ton and a third, and the lowest price of rags is £15 per ton.

These remarks on new materials for paper are essentially fragmentary; there are many other substitutes, and some not generally known to the public, which have been patented and experimented upon within the past two or three years; but to enter into any particulars concerning them would extend this paper far beyond the limits I have assigned to it.

It would not be an uninteresting or impossible inquiry to ascertain the history and progress of this question of rag substitutes for paper during the past seven years—a subject to which I may return at some future opportunity.

Trinity School House, Lambeth.

SUBMARINE NAVIGATION.

An American invention has just been brought to this country, with a view to its being disposed of either to this or any other European government, and which, if it does one-half of what the patentee guarantees can be done with it, will make such a change in the mode of carrying on a naval war as will put steamers out of the question, and render of no avail the tremendous forts of Cronsdadt or Cherbourg. It is nothing less than a submarine boat,* made only for working under water, in form much resembling the shape of a porpoise, but capable of being made large enough to contain 8, 10, or even 15 men if necessary, with a proportionate quantity of explosives. In a kind of specification which has now been laid before this and the French Government, the patentee says he has invented and constructed a submarine boat, weighing about 8 tons, in which he has, with others, sunk in Lake Michigan, and remained under water for four hours, without any air tubes or other communication leading from his boat above the surface of the water, and propelled the boat in and near the bottom of the lake for several miles, at the rate of about three miles an hour. He has, while in his boat and under water, by means of machinery working through its side, sawed off timbers 14 inches square. He can sink his boat from the surface almost instantly, either to a few inches or feet from the surface of the water, or to 100, or more feet, and again rise quickly or very slowly to or near the surface; go forward, back, or sideways, or come up bows first or otherwise, as may be required. He can attach powder torpedos to the outside of his boat on its deck or sides, and proceed under water out to sea, in any weather, to an enemy's ship in sight, fix or anchor the torpedos under the ship's bottom, set in motion clockwork to fire the torpedos, simultaneously or at intervals, and retire, still under water, out of danger from the explosion and out of reach of an enemy's guns. He can also convey powder torpedos inside his boat of 100lb. (or more) weight, and when under an enemy's ship, pass them out of the side of his boat, through his patent hatch, and fasten them to a ship's bottom and fire them as above-named. He can enter an enemy's harbour under water and make surveys, only showing above the surface a sight tube no more than one half-inch in diameter, and retire still under water, and proceed outside to sea and make his report to the commander of a fleet or ship. He can go out to sea, meet a hostile fleet, go under their bottoms, fix torpedos to go off by clockwork, or bore holes in their bottoms and come away unseen. With a large boat he can carry a 12 or a 24 pound (or even larger) gun in the forward end of his boat near the top, so rigged that he can load in 100 feet depth of water, rise near to the surface, sight the horizon for an enemy's ship, and if one is in sight take the course for her and proceed towards her, even within a stone's throw, rise quickly, so near the surface as only to show the muzzle of the gun through the outside porthole valve, aim at the ship near her water line, fire, then instantly sink to reload, and rise at another point to fire again and repeat. If required, with a large boat, he can remain under water with several men with him, and do service at sea off or in the harbour for several days, without landing or showing one inch of his boat above water. If the boat is required for pearl fishing he can work all day on a pearl bed, raking up and taking in pearls and suffering no inconvenience from impure air, and as the boat is provided with light for deep water work, he can move about on the bottom like a fish, and see pearls where a diver would not. If the boat is required to visit wrecks and remove treasures or goods, it is so constructed that he can saw, bore, or make fast chains or ropes to any point of a wreck, and if required, one or more persons can, while under water, go out of the boat through the side-hatches, enter a wreck or do other service, and return inside of the boat again without inconvenience.

THE STEAM NAVY OF FRANCE.

The following letter has been addressed to the editor of the *Times*:—

"Sir,—In the leading article on the navies of England and France, in the *Times* of Saturday last, you gave a very accurate summary of facts respecting the strength of the French steam navy. If you can spare me the required space, I shall be happy to set forth in detail the successive steps by which that navy has attained its formidable proportions. This I am enabled to do by the receipt of information which reached me too late for insertion in my paper on the navy read at the Society of Arts. I shall draw no political inferences from the facts before me, but simply give numbers and dates for the guidance of those who may desire to draw them.

On the 1st of January, 1850, the steam navy of France consisted of 20 frigates and 86 corvettes and despatch vessels. Of the frigates, two were of 650, two of 540, and 16 of 450 horse-power each; of the smaller vessels one only was of more than 320 horse-power, and most of them were of less than 200. There was not a single line-of-battle steam-ship then afloat in any harbour of France, but, during the year, the *Napoleon*, of 900 horse-power, was launched, and the *Montebello*, a sailing ship, was converted into a steamer, with engines of 140 horse-power only. Two smaller vessels, either corvettes or despatch vessels, were likewise launched in 1850. During the year 1851, no ships of the line and no frigates were added to the French navy; four small vessels formed the only increase of that period. In December, 1851, therefore, the number of vessels composing that navy was 114 in all. In 1852, three ships of the line were added—the *Austerlitz*, of 500 horse-power, and the *Charlemagne* and *Jean Bart*, each of 450 horse-power. Beside these, one frigate, of 260 horse-power, and two smaller vessels, each of 400 horse-power, were launched. In 1853, four more ships of the line floated in French ports, each of 650 horse-power—the *Fleurus*, the *Prince Jerome*, the *Duquesne*, and the *Tourville*; and to these were added seven corvettes and despatch-vessels, three of them of 400 horse-power each. The next year, 1854, brought an increase of five line-of-battle ships; one of them, the *Bretagne*, a new ship, of no less than 1,200 nominal horse-power, and the other four each of 650 horse-power, comprising the *Ulm*, the *Navarin*, the *Wagram*, and the *Souverain*. The number of smaller vessels remained stationary during that year. In 1855, the increase in the line-of-battle ships was six, viz., the *Eylau*, the *Redoubtable*, the *Arcole*, and the *Algésiras*, all new ships, with engines of 900 horse-power each, and the *Tislit* and *Breslau*, converted ships, of 500 horse-power each. This year, the most active year of the Russian war, also brought into existence five floating batteries, 28 gunboats, and 14 screw transports. (I would, in passing, correct an error in the article from the *Conversations Lexicon*, respecting the floating-batteries. The writer says:—'The English batteries were complete failures, and could not even be propelled; the French, on the contrary, were excellent, and answered their purpose.' The truth is, the English and French floating batteries were, to the number of four or five—I forget, at the moment, which—built from precisely the same lines, and were in all their main features alike.) In 1856, seven additional line-of-battle ships were floated; of these the *Imperial* and the *Alexandre* were new, and of 900 and 800 horse-power respectively; while the *Louis Quatorze*, the *Tage*, the *Duguay Trouin*, the *Donawerth*, and the *Duguesclin* were converted, and fitted with engines varying in horse-power from 600 to 450. During the same year, 12 frigates, five of them of 800 horse-power, were added, and the number of corvettes and despatch vessels was reduced by ten. The number of floating batteries and gun-boats remained the same as in 1855, and has, indeed, continued the same until now. The screw transports were not added to this year. The *Ville de Paris* and the *Turenne*, each of 600 horse-power, and the *St. Louis*, of 450, were the only line-of-battle ships added in 1857. The frigates were increased by four, the corvettes by one, and the transports by six in that year. In 1858, the *Ville de Nantes*, of 900 horse-power, and the *Fontenoy*, of 650, both new ships of the line, with four corvettes and three transports, were launched.

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* In the discussion upon Major Sears' paper on "Submarine Engineering and Exploration," read before the Society in March, 1857, Sir Charles Fox drew attention to an invention of an apparently similar character.—See *Journal*, Vol. V., page 249.

"If the foregoing numbers be brought together, they give these results—viz., that during the last seven years—that is, since the flash of the *coup d'état* prepared the world for the Empire's thunder—the number of French steam-ships of war has been more than doubled (being 114 in January, 1852, and 230 in January, 1859), and the number of steam line-of-battle ships raised from two to 32. To complete the statement of the case it is necessary to add that at the present moment eight ships of the line and 25 frigates and smaller vessels are building in the French dockyards. The line-of-battle ships are the *Intrepide*, the *Ville de Bordeaux*, the *Ville de Lyon*, the *Gloire*, the *Invincible*, and the *Normandie*, 900 horse-power each; and the *Massena*, and *Castiglione*, 800 each. The *Gloire*, the *Invincible*, and the *Normandie* are building on the lines of the *Napoleon* razeed, and are to be sheathed with thick iron plates. The order for the conversion of two other ships of the line, the *Friedland* and the *Bayard*, has been issued, but the works have not yet been commenced.

"From the foregoing facts it appears that since the supreme power of the French nation has been in the hands of Louis Napoleon, the French navy has received an average increase of from four to five steamships of the line annually; and the number of similar ships now on the stocks gives an unmistakeable proof of his intention to exceed that average this year. In your article of Saturday last, you have shown with perfect clearness that, notwithstanding these great strides, we have the strongest steam navy in the world; and I endeavoured in the Society of Arts paper to prove that, with an efficient Channel fleet, we should stand in no peril of invasion. But the steady and enormous increase of the French steam navy in large ships appears to point to something very different from a sudden and unsupported descent upon our coast. Two-deck and three-deck steamships are by no means the most fitting vessels for effecting such an operation. They are intended, as their name implies, for the line of battle, and their production in large numbers by the French Emperor is equivalent to a declaration that if we have to meet his forces at all, it will not be on our coasts or in our harbours alone. He is manifestly preparing to meet us, if need be, or if occasion serve, on the open sea, and to contend there for a mastery of infinitely greater value to him than any mere momentary advantage.

"These are not alarmist notions, but plain matters of fact; and they raise the question,—Is England, with her home interests, her Mediterranean ports and islands, and her wide-spread colonies, to see herself surpassed, or even equalled, in her lines of battle, by a neighbouring Power which has but little save its own seaboard to defend?

"I am, Sir, your obedient servant,

"E. J. REED.

"London, Jan. 10."

Home Correspondence.

THE SHIPS OF THE ROYAL NAVY.

Sir,—I regret if, from an ambiguity in my letter on Mr. Reed's paper, it can be supposed that I objected to his mode of comparing vessels. I said, "It is extraordinary that men will continue to compare the tonnage of vessels, *as if a proper standard were actually in use*."

Mr. Reed does not so compare them, for he allows the rules are defective. He agrees, then, in my proposition, and I fully agree with his reasons for omitting to discuss the said rules in his paper. I am, &c.,

J. MACGREGOR.

Temple, Jan. 7th, 1859.

RAFT SHIPPING.

Sir,—Many suggestions have, of late, been brought before the public on the construction of gun boats, mortar boats, and floating batteries, with a view to making them invulnerable; and I now beg to add my views on that subject. Why not make the floating body for such special services, up to the line of its load displacement, a solid mass of material, of such specific gravity lighter than water, that it shall not sink, however much it may be perforated by shot? It appears to me that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flocks, hemp, and other light materials, which, by the aid of a solution of gutta percha, or other chemical process, would form a solidifying mass so tough, that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and, therefore, unsinkable, however perforated by shot, and capable of carrying armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. Such vessels, of light draught, accompanying fleets of war as tenders to line-of-battle ships, whence they might be manned and stored as occasion may require, would, I submit, form a useful auxiliary, available for shore service or attacking land batteries, which deep-draught ships of the line cannot approach, and would be sunk if they could.

I may observe that this idea was first broached by me two years since, as being applicable to the construction of vessels for carrying treasure and valuables, as diamonds and gold dust. They might be wrecked ashore, but the treasure would be recoverable. I am, &c.,

CHAS. ATHERTON.

Woolwich Dockyard, January 10th, 1859.

THE LONDON MECHANICS' INSTITUTION AND LORD BROUGHAM.

SIR,—It cannot remain an open question whether Lord Brougham is to be left alone to sustain, as it were, by way of penalty, pecuniary shortcomings due to his first step in behalf of educational institutions, such as that of which the London Mechanics' Institution is the type.

What higher privilege for "Institutions in union with the Society of Arts," than to raise the comparatively small amount of deficiency in the form of voluntary contributions by their members.

If you recognize in this suggestion an appropriate method of testifying to the pioneer of a noble cause (while his career is mercifully prolonged to sustain emulative aspirations), that his spirit will survive and command sympathy for his ends and aims, then please publish this note, and allow me to offer my mite through the Manchester Mechanics' Institution, which I invite to take its share in the collection. It was there, as a humble fellow-labourer of Sir Benjamin Heywood, that I first had the honour to greet the great Lord Brougham.

I am, &c.,
AN EX-DIRECTOR OF THE
MANCHESTER MECHANICS' INSTITUTION.

London, January 10, 1859.

THE PATENT OFFICE LIBRARY.

SIR,—The Council has urged upon the members of ths Society the importance of communicating detailed accounts of new processes in arts, or methods of manufacture, of any modifications by which these may be simplified, or labour saved, and of any novel application of raw materials, whether previously known or not, to useful purposes. It has, moreover, thrown out a hint that it may be quite possible that some of the things set down in a long list of *desiderata* as to be done, may already have been accomplished, but that in such cases the knowledge of them is limited.

Now, with the view, sir, of responding, for my own part, to that laudable appeal, I beg to call the attention of professional men, mechanics, and writers on technical subjects, to the valuable records of human ingenuity abroad, which have most liberally been collected for the last few years at the Public Free Library of the Great Seal Patent Office. From the contents of that library, which increases every day in wealth, though not in space, allow me only to quote at random the following:—

"Description des machines et procédés pour lesquels des brevets d'invention ont été pris en France, 112 volumes, 4to.*

"Comptes rendus de l'Academie des Sciences, 43 vols. 4to.

"Bulletin de la Société d'Encouragement pour l'Industrie Uationale, 56 vols. 4to.

"Dingler's Polytechnisches Journal, 137 vols.

"Jahrbucher des Polytechnischen Instituts in Wien, 20 vol.

"Verhandlungen des Vereins zur Beforderung des Gewerbfleisses in Preussen, 32 vol. 4to.

"Recueil spécial des brevets d'invention en Belgique.

"Descrizione del macchine e procedimenti per cui vennero accordati attestati di Privativa nei Stati Sardi," etc., etc.

I think that on the greater part of the 145 subjects proposed by the council for investigation, a new light might be thrown by a careful perusal of such publications as the above, and progress insured by taking advantage of the very negative results of former attempts in the same line. The secret of modern invention, moreover, lying in the skill of combining or modifying known power or effects, rather than in the creation or discovery of absolutely new principles or elements, the history of inventions is as little to be neglected in industrial pursuits as general history in political affairs. By adopting that course, intelligent men, with a creative spark in them, may glean much, if not make an abundant harvest, and, as the common saying has it: "Many a little makes a mickle."

I am, &c.,
ALEXANDER TOLHAUSEN.

London, 4th Jan., 1859.

Proceedings of Institutions.

MACCLESFIELD USEFUL KNOWLEDGE SOCIETY.—The twenty-third anniversary of the Society for Diffusing Useful Knowledge was held in the Town-hall, on Monday, the 8th of November last. There was, as usual, a large attendance, including many ladies. In the unavoidable absence of the President, John Brocklehurst, Esq., M.P., the chair was occupied by T. Brodrick, Esq., the Senior Vice-President of the Society. There were also present, Lord Stanley of Alderley, E. C. Egerton, Esq., M.P., Samuel Greg, Esq., the Mayor of Macclesfield (F. Jackson, Esq.), the Rev. W. R. B. Arthy, Rev. T. M. Cookesley, Rev. J. Armstrong (Wesleyan Minister), J. May, Esq., W. Bullock, Esq., S. Barton, Esq., W. Potts, Esq., &c.—The Chairman in opening the proceedings, expressed his regret at the unavoidable absence of the President.—The Hon. Secretary then read the twenty-third annual report, for the year 1858, from which it appears that this Society, like every other voluntary institution in the town, has, during the past year of panic and trial, experienced a slight diminution of its income, and consequently has not been as eminently effective as it has hitherto been, and no doubt will be again when trade revives; nevertheless, it has not been inactive. The students, considering the straitened means of many, have praiseworthily clung to it; and in its educational department it can present a goodly array of diligent and persevering pupils. In the recent Examinations of the Society of Arts, five certificates of excellence were granted to four of the pupils by the Council, and one certificate of excellence and two reports of honourable mention have been granted and made by the Examiners at Manchester. The Committee are happy to state that these examinations have infused a spirit of diligence and perseverance into all the classes, which it is hoped will be the means of the pupils gaining more certificates next year. Two lectures have been given during the year, by Samuel Greg and George Melly, Esqrs., the one on "An Hour with the Poets," and the other "An Hour with Charles Dickens," and to both those gentlemen the Committee tender their thanks. Three concerts have been held during the year, which, as usual, have given great satisfaction. No material addition has been made to the library, but the Committee have to thank several of the members for contributions to it. In order to reduce the debt which has been incurred in erecting the new Reading Room, and in the various additions and improvements which have been made to and in the Society's premises, it is intended to hold a fête bazaar in aid of the building fund. C. R. B. Leigh, Esq., of Adlington Hall, has kindly placed his park and gardens at the disposal of the committee for that purpose. The committee urge upon the members the importance of a diligent attendance at the classes, and mention that E. C. Egerton, Esq., M.P., has most kindly continued, and promises to continue, his annual donation of five guineas for prizes for the pupils generally; and that Mr. Swinnerton has also continued his donation of one guinea for a prize to the most deserving pupil in the stenographical class.—Lord Stanley of Alderley, in moving the adoption of the report, said that considering the severe distress which the town had been suffering, it was satisfactory to find that the subscriptions had so nearly met the Society's expenses. It was now nearly twenty-five years since the Institution was established, and he had watched its progress with much attention. There was, however, one point with respect to which he must express his regret—the failure of the system of lectures. He thought these should be made amusing as well as instructive, if they were to attract large audiences. He was also of opinion that the better class of light literature should form a part of the library, as affording a wholesome relaxation. He thought the School of Design in connection with the Institution most valuable, and he had had great satisfaction in seeing the progress which the pupils had made, as shewn by the drawings sent up to London, which were very satisfactory.—The Rev. W. R. B. Arthy seconded the adoption of the report, which was carried. The prizes were then distributed to the respective students, the Chairman, Lord Stanley, and Mr. Egerton, taking part in the presentation, and offering a few words of encouragement and advice to the recipients. Mr. E. C. Egerton, M.P., moved a vote of thanks to the officers of the Society for their valuable and unremitting services during the past year. This was seconded by the Rev. J. A. Armstrong, (Wesleyan Minister). The meeting was afterwards addressed by Mr. Greg, Mr. John May, the Mayor of Macclesfield, Mr. David Chadwick (of Manchester), and other gentlemen, and concluded with a vote of thanks to the chairman.

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* An English index of this work is in the press.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Prof. Huxley, "On Biology."
Medical, 8.
Tues. ......Civil Engineers, 8.
Statistical, 8. Mr. Edwin Chadwick, "On the Statistical Evidence of the Results of Competition for Whole Fields of Service."
Pathological, 8.
Wed. ......Royal Soc. Lit., 4½.
Meteorological, 7.
London Inst., 7. Conversazione.
Society of Arts, 8. Mons. Théophile Silvestre, on "Les Arts, les Artistes, et l'Industrie en Angleterre depuis la dernière moitié du dix-huitième Siècle jusqu'à ce jour."
Geological, 8. I. Mr. H. Rosales, "On the Gold-field of Ballarat." II. Dr. J. Harley, "On a new Species of Cephalaspis from near Ludlow."
Ethnological, 8½.
Thurs. ...Royal Society Club, 6.
Antiquaries, 8.
Linnæan, 8. I. Dr. Carpenter, "On Tomopteris onisciformis." II. Dr. Cobbold, "On some new forms of Entozoa."
Chemical, 8.
Royal, 8½.
Sat. ......Asiatic, 2.
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 7, 1859.]

Dated 15th September, 1858.

2154. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—The separation of iron and steel from their combination with certain foreign bodies. (A com.)

Dated 9th November, 1858.

2506. M. Henry, 84, Fleet-street—Imp. in, and in the manufacture of locks and fastenings, and keys for the same.

Dated 7th December, 1858.

2804. J. V. Scarborough, Belfast, Ireland—Imp. in apparatus for the manufacture of boots and shoes.

Dated 9th December, 1858.

2830. E. L. Pensuete, Dunkirk, France—Imp. in apparatus for driving or for drawing up piles by steam.

Dated 21st December, 1858.

2913. R. McLean Livingston, Alabama, U.S.—An improved self-detaching "safety hook" or coupling.
2915. J. H. Bolton and C. Garforth, Chester—Certain imp. in drying yarns or fabrics, and in the apparatus connected therewith.
2917. W. S. Yates, Leeds—Machinery or apparatus for dragging bristles and drawing air and vegetable fibre.
2919. W. Mainwaring, Brunfield, Herefordshire—Imp. in brakes for common road vehicles.

Dated 22nd December, 1858.

2921. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.
2923. J. Nicholson, Halifax, and D. Crossley, Brighouse, Yorkshire—Imp. in Jacquard machinery or apparatus employed in weaving.
2925. W. Spence, 50, Chancery-lane—Imp. in granaries or apparatus for preserving grain. (A com.)
2927. E. Green, Wakefield—Imp. in tables.
2929. E. Ransome, Ipswich—Imp. in the manufacture of grinding and rubbing surfaces.
2931. J. J. Welch, 17, Cheapside—Imp. in the manufacture of neckties, scarfs, or cravats.

Dated 23rd December, 1858.

2933. J. Ronald, Liverpool—Imp. in, and machinery for, the manufacture of "hard-tapped" and "soft laid" twine, "mill banding" strands for ropes and other purposes, and cordage generally from hemp, flax, cotton, and other like fibrous material.
2935. J. Broom, Glasgow—Imp. in the manufacture of steel.
2937. A. Barclay, Kilmarnock, N.B.—Imp. in obtaining and distributing or applying electricity and magnetism, and in obtaining motive power therefrom.

Dated 24th December, 1858.

2939. J. T. P. Newbon and T. Smith, Fenchurch-street, and J. Brown, Follit-street—Imp. in machinery or apparatus for raising and lowering or otherwise moving heavy weights.
2491. J. W. Child, Halifax—Imp. in the manufacture of fabrics adapted to be used for curtains, coverings of furniture, table covers, and such like uses.
2943. L. D. Owen, 192, Tottenham-court-road—Imp. in manufacturing horse shoe nails. (A com.)
2945. D. Edleston, Halifax—Imp. in preparing and finishing textile fabrics, and in the means or apparatus employed therein.
2947. E. Humphrys, Deptford—Imp. in brazing metal tubes in tube plates and other metal surfaces to each other.
2949. J. Little, Glasgow—Imp. in lamps.
2951. R. L. Giandonati, St. Paul's Churchyard—Imp. in ornamenting leather cloth.

Inventions with Complete Specifications Filed.

[*From Gazette, Dec.* 31, 1858.]

2953. M. A. E. Mennons, 39, Rue de l'Echiquier, Paris—An improved composition for the protection of certain metallic surfaces. (A com.)—27th December, 1858.
2957. J. Shaw, Manchester—A new mechanical combination, called an indefinite feed movement.—27th December, 1858.

[*From Gazette, Jan.* 7, 1859.]

26. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Certain imp. in steam generators. (A com.)—3rd January, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Jan.* 7, 1859.]

January 5th, 1859.

1508. G. J. Newbery.
1510. T. Woolner.
1515. H. Hughes.
1517. J. Davis and T. Evans.
1518. J. Buchanan.

January 7th.

1519. W. A. Smith.
1520. H. C. Schiller.
1524. W. Clissold.
1531. J. Marland and J. Widdall.
1532. H. Gidlow.
1534. P. F. Demoulin and J. Cotelle.
1525. T. T. Chellingworth.
1537. R. Smith.
1541. R. G. C. Fane.
1543. G. Collier.
1546. G. Parsons.
1548. F. Sang & T. W. Rammell.
1549. C. N. Kottula.
1551. J. M. Rowan.
1554. G. H. Wain.
1588. T. Wheeler.
1608. A. P. Price.
1622. H. Smith.
1635. J. C. Hill.
1674. D. Adamson.
1690. J. Scott.
1756. T. Greenhalgh.
1782. J. Henderson.
1809. T. Ingram.
1825. S. F. Cottam.
2000. E. Cocker.
2050. J. L. Chester.
2080. W. Riley.
2350. C. W. Williams and G. Eyton.
2430. C. Vero and J. Everitt.
2449. N. S. Dodge.
2549. D. Auld.
2579. F. A. Gatty.
2581. M. A. Muir and J. McIlwham.

[*From Gazette, January* 11, 1859.]

January 11th.

1563. R. A. Brooman.
1567. T. Earnshaw.
1572. J. Edwards and T. Newey.
1573. J. J. Field.
1585. E. Owen.
1591. J. Fowler, junr.
1595. C. P. Aston.
1607. P. Arkell and A. Melhado.
1611. W. A. B. Bennett.
1637. C. Doley, E. Bigland, and T. H. Worrall.
1649. J. W. Giles.
1655. W. L. Thomas.
1739. E. J. M. Cotti.
1775. L. Hall.
1805. J. H. Johnson.
1869. A. V. Newton.
2141. J. Wilson.
2605. J. Oakes.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, Jan.* 7, 1859.]

January 3rd.

44. H. Bessemer.
71. J. Ashworth.

January 4th.

86. W. Pole and F. W. Kitson.
108. J. Hostage, T. I. B. Hostage, and J. Tatlock.

January 5th.

55. R. A. Brooman.

[*From Gazette, January* 11, 1859.]

January 6th.

53. S. C. Lister and W. Tongue.

January 8th.

77. M. Billing & F. A. Harwood.
116. J. Abraham.
117. J. Hamilton, jun.

Journal of the Society of Arts.

FRIDAY, JANUARY 21, 1859.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Carshalton.

Mr. J. Aiken, the Park, Carshalton.
Rev. G. Capel, M.A., Wallington, near Carshalton.
Mr. W. E. Creasy, surgeon, Carshalton.
Rev. F. N. Ripley, M.A., Carshalton.
Mr. Wm. Manley, West-street, Carshalton, *Secretary.*

For the Holbeck Church Institute (near Leeds).

Rev. A. J. Brameld, Vicar of New Wortley, Leeds.
Rev. J. C. Wilson, Marshall-street, Holbeck.
Rev. J. H. F. Kendall, Holbeck Parsonage, Leeds, *Secretary.*

For the London Mechanics' Institution.

Mr. G. Barnard.
Mr. S. Vallentine.
Mr. T. A. Reed, 41, Chancery-lane, *Secretary.*

For West Hartlepool.

Mr. James R. Anderson, schoolmaster.
Mr. Charles Baker, accountant.
Mr. Harrison Burnham, assistant-overseer of the poor, and late schoolmaster.
Mr. William Hutton, F.G.S.
Mr. Christopher Salmon.
Mr. W. C. J. West, architect.
Mr. Wm. W. Brunton, solicitor and notary, *Secretary.*

For York.

Mr. James Birchall, Gillygate, York.
Mr. Samuel Wm. North, M.R.C.S., Castlegate, York.
Rev. H. O. Palmer, Trinity-lane, York.
Mr. W. H. Parr, M.A., Blake-street, York.
Rev. Canon Robinson, M.A., Principal of the Diocesan Training College, Lord Mayor's-walk, York.
Rev. George Rowe, M.A., Lord Mayor's-walk, York.
Mr. William Tomlinson, F.R.A.S., the Groves, York.
Mr. Ed. Birks, *Secretary.*

SEVENTH ORDINARY MEETING.

Wednesday, Jan. 19, 1859.

The Seventh Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 19th inst., Sir Charles Eastlake, President of the Royal Academy, in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Dodd, Charles Edward.
Horne, Edward.
Johnson, Fred. Hardwick.
Versemann, Frederick H. S.

The following Institutions have been taken into Union since the last announcement:—

Troubridge, Mechanics' Institution.
Paisley, Artisans' Institution.
Brompton, Church of England Young Mens' Society.
Islington, St. Mary Working Mens' Institute.

The Chairman said that he would take the opportunity of stating that M. Silvestre had received a commission from the French Government, to make a careful study of the British Schools of Art, for the benefit of Art in general. He was sure he spoke the sentiments, not only of the Society of Arts and the Royal Academy, but of every individual connected with art, when he said that they were deeply sensible of the honour conferred upon art and artists in this country by the steps which the French Government had taken; for it was to be remarked, and perhaps M. Silvestre would have an opportunity of stating that fact, that this movement was not the result of ordinary curiosity, but was the deliberate consequence of a genuine admiration on the part of the French nation, occasioned by the Exhibitions in Paris and Manchester. He had no doubt artists and lovers of art in this country would be ready to lend every assistance to M. Silvestre in the prosecution of his object. He would inform the meeting that the paper which M. Silvestre was about to read, which was in fact an abridgement of his history or analysis of British art, would be read in French, and, therefore, in the discussion which would follow, it would be desirable, in order that M. Silvestre might profit by the remarks made, that they should be offered in French. The Chairman then addressed some complimentary observations to M. Silvestre in the French language, and called upon him to read his paper.

The Paper read was—

LES ARTS, LES ARTISTES, ET L'INDUSTRIE EN ANGLETERRE DEPUIS LA DERNIÈRE MOITIÉ DU DIX-HUITIÈME SIÈCLE JUSQU'À CE JOUR.

By M. Théophile Silvestre.

Monsieur le Président, Messieurs,—Ce n'est pas sans un profond sentiment de respect que j'ose prendre la parole en présence de cette noble et vigoureuse Société, établie depuis plus d'un siècle pour l'Encouragement des Arts, des Manufactures et du Commerce, illustrée par les intelligences les plus actives et les plus dévouées de la Grande Bretagne, successivement présidée par des citoyens éminents et même par des Princes, depuis les Lords Folkstone et Romney, de très vénérable mémoire, jusqu'à Son Altesse Royale le Prince Consort, votre Président actuel, qui, par ses lumières personnelles, relève encore l'éclat de son rang.

Je n'ai point à faire ici l'éloge de la Société des Arts, qui, préférant toujours l'efficacité de l'action aux vanités de la parole, a tant fait pour l'éducation et la prospérité publiques depuis la dernière moitié du dernier siècle, et qui, dès sa fondation, eut l'immortel Franklin pour admirateur et pour correspondant.

S'appliquant d'abord avec un grand bon sens à tous les moyens de développer le bien-être de la nation, principe premier de son indépendance, il n'est pas un essai, une invention, un progrès, qu'elle n'ait protégé dans l'art, dans la science, dans l'agriculture et dans l'industrie. C'est elle qui a provoqué le dessèchement des marais, le défrichement des landes, le reboisement des forêts, l'aménagement de tous les genres de culture: chanvre, garance, plantes nutritives, pharmaceutiques et tinctoriales; c'est elle qui a perfectionné les instruments de labour, de charroi, de drainage, d'irrigation, d'assainissement, et mis ces armes de la Paix, de la Fécondité, aux mains de la vaillante Angleterre.

Non contente de multiplier dans la métropole ses expériences, comme autant de bienfaits de civilisation, la Société des Arts a développé, régularisé le commerce et l'industrie des colonies, donné sa forte impulsion aux pêcheries, accompli la réforme postale, réclamé la refonte des monnaies, l'abolition de l'impôt sur le papier, impôt qui restreint le développement du commerce et

frappe en même temps la liberté de la pensée; proposé, enfin, l'adoption de ce système décimal, dont la simple précision est un des traits frappants de la rectitude et de la netteté du génie de la France.

Pour faire avancer à grands pas l'art et la science, pour vaincre les monopoles injustes, pour briser les restrictions fiscales, la très éclairée et très persévérante Société des Arts étend sa propagande sur tous les points du monde. Dans le seul Royaume Uni plus de trois cents sociétés, basées sur ses principes, lui sont affiliées. Loin d'empiéter sur leurs priviléges provinciaux, loin d'absorber leurs libertés locales, la Société des Arts leur prête l'irrésistible appui de son pouvoir central métropolitain, et, par cet esprit de justice, de modération, de solidarité, sait se concilier l'estime et le dévouement des hommes les plus influents du pays. Aussi toutes ses initiatives, toutes ses résolutions ont-elles un triple caractère d'ampleur, d'énergie et de patriotisme. La Société des Arts marche comme un seul homme, et la nation la suit. Les intelligences s'animent, les volontés s'unissent, les millions circulent. Ce qu'elle veut est fait: l'Exhibition de 1851 ouvrît ses portes; celle 1861 les ouvrira. A la vue des merveilles de l'art et de l'industrie, les peuples étonnés commencent à oublier les luttes sanglantes de leurs pères, et à comprendre que désormais la seule guerre possible est celle du travail et du génie.

Après avoir assuré le progrès des Arts utiles, Messieurs, vous avez protégé les Beaux-Arts, qui sont la fleur de l'esprit des nations opulentes. Glorifiant la peinture, l'architecture, la statuaire, vous avez ouvert des concours, donné des médailles aux enfants de la nobility, de la gentry et du peuple, et prouvé, comme il convient à des hommes libres, que vous savez récompenser le mérite dans toutes les classes de l'empire. Vous voyez sans la moindre jalousie nationale, ce qui est encore un des traits de la noblesse de votre caractère, briller à Londres quelques artistes éminents de la France et de l'Italie. J'en aperçois plusieurs, au moment même où je vous parle, décorés, avec quelques uns des vôtres, de l'étoile de la Légion d'honneur par l'auguste main de Sa Majesté l'Empereur des Français à l'Exposition universelle de Paris.

Dans cette enceinte, embellie par les pinceaux de Barry, de Reynolds, et de Gainsborough, vous avez couronné Flaxman, Sir Thomas Lawrence, d'immortel souvenir, Sir Edwin Landseer, Mulready, Millais et tant d'autres artistes vivants illustres, dont je suis venu étudier en Angleterre les beaux ouvrages, par ordre de Son Excellence le Ministre d'Etat et de la Maison de l'Empereur des Français, ministre éminent, intelligence fidèle aux grandes traditions de l'art, et qui sait découvrir d'un regard supérieur les beautés distinctives de toutes les écoles.

Merci, Messieurs, merci de votre attention hospitalière. J'en dois à la fois l'honneur à votre générosité naturelle, au sentiment de l'alliance de votre pays avec le mien, au mandat que je tiens du Ministre de France. Permettez moi, Messieurs, d'en rapporter l'honneur à Son Excellence.

Ce qui me touche profondément, Messieurs, c'est l'excès même de votre indulgence. Aujourd'hui, pour la première fois, vous voulez bien permettre à un français de vous parler sa langue dans cette vénérable enceinte. Cette haute faveur, dont je voudrais savoir me rendre digne, est une nouvelle preuve de votre supériorité.

J'oserai néanmoins vous entretenir, Messieurs, d'un sujet qui vous inspire tant d'affection et de légitime fierté, "l'Art et les Artistes en Angleterre." Vous connaissez beaucoup mieux que je ne la connais moi-même votre école nationale, qui, par ses allures vivantes et libres, a pris un si beau rang entre les plus illustres écoles du continent. Elle a grandi au milieu de vous, de vos professeurs et de vos écrivains, qui, dans leurs *Lectures* ou dans leurs livres, ont parlé des Beaux-Arts à des points de vue différents, souvent opposés, toujours remarquables: Reynolds, Fuseli, Barry, Northcote, E. Edwards, Cunningham, Landseer, Constable, Sir Charles Eastlake, Charles Robert Leslie, Digby Wyatt, Owen Jones, John Ruskin, et tant d'autres juges éminents dont je voudrais citer ici tous les noms, qui, d'ailleurs, sont populaires dans ce pays et bien connus en Europe.

Durant les siècles qui ont précédé le temps de William Hogarth, votre pays, Messieurs, n'eut guère à son service que des artistes étrangers. Mais, comme tout ce qui plaît aux yeux et frappe l'imagination relève directement de l'art, je ne dois pas passer sous silence ces dames Anglaises du règne de Henry VIII, de nobles et véritables artistes, qui, de leurs belles et pieuses mains retraçaient en tapisseries les épisodes de l'histoire sainte dans les hautes salles des manoirs. A la vue de ces vénérables images, qui, parfois, au souffle du vent, semblaient se mouvoir et grandir comme des apparitions fantastiques, les châtelaines sentaient battre leur cœur, et les vieillards, fermant la Bible, relevaient leurs têtes attentives, comme si Moïse lui-même allait leur parler.

Pour rivaliser avec la splendeur et la magnificence de Charles Quint et de François 1er, Henry VIII, votre roi, avait besoin de grands artistes: Holbein vint faire chez vous ces chefs-d'œuvre que l'Europe entière vous envie, ces immortels portraits de princes, de ministres, de guerriers, de législateurs, de courtisans, de reines infortunées, que le monarque prit pour instruments et pour victimes de ses dures et robustes passions. De ces peintures de Holbein, soyez en fiers, Messieurs, votre pays les inspira. Leur vérité, naïve et rigide, arrête les fantaisies et réprime les écarts de l'historien. Vos artistes, tout en restant eux-mêmes, ont gardé quelque chose de la simplicité, de l'exactitude, de la fermeté de Holbein.

Du court et triste règne de Marie, vous avez retenu au passage quelques mâles et altières figures d'Antoine Moor, le sombre et violent peintre du violent et sombre Philippe d'Espagne. Au grand règne d'Elisabeth—qui, à toutes les merveilles de l'art préférait sa propre image, qui proscrivait les miroirs et les peintres fidèles, et qui ne voulait pas plus d'ombre dans la peinture de son portrait que dans l'éclat de son omnipotence—vous devez l'Italien Zucchero, maître plein d'élégance, l'Allemand Lucas de Heere, disciple attentif de Holbein; Cornelius Vroom, le peintre de vos victoires sur l'Armada; Hilliard et Oliver, vos compatriotes, restés célèbres par leurs miniatures, portées comme des bijoux par les personnages de la cour.

Vous étiez puissants et somptueux; mais les artistes illustres du continent ne venaient guère alors vous rendre visite. Les sujets favoris de leurs peintures semblaient porter atteinte à l'austérité de vos sentiments. Le roi Jacques 1er aimait pourtant les arts et protégeait Mytens, peintre solide mais sans noblesse. Sous le règne à la fois si brillant et si sombre de Charles 1er, qui, avec plus d'intelligence, ressemble tant à notre Louis XVI, l'Angleterre prit vivement le goût des arts, à l'exemple du souverain éclairé qui avait pour peintres Rubens et Van Dyck, et pour architecte Inigo Jones. C'est alors que vos pères eurent le bonheur de connaître et d'honorer Léonard de Vinci, Raphael, le Corrége, le Titien, Véronèse, le Tintoret, tous les maîtres souverains qui ont fixé dans leurs œuvres la perfection des formes de l'homme et la sublimité de ses sentiments. La pureté du goût chez les nations actives et robustes est lente à venir. Vos pères n'avaient vu dans l'art des premiers temps qu'une profusion de matières précieuses; l'art les touchait par l'abondance, surtout par la cherté de ses productions. Ils aimaient, comme l'a si bien dit un de vos historiens, "des rois d'or avec des couronnes d'or, des anges d'or avec des aîles d'or, des vierges d'or nourissant des enfants d'or, assises sur des nuages d'or. Le ciel était d'or, la terre était d'or." Mais, sous Charles 1er, vous donniez l'or à pleines mains, comme vous le faites aujourd'hui, pour une belle toile. Van Dyck menait à Londres le train fastueux d'un prince; l'artiste était prince en effet par les dons du génie. Votre pays lui doit d'avoir porté jusqu'aux extrémités du monde l'immortelle beauté de vos femmes et la fière tournure de vos cavaliers.

Vint le terrible temps du puritanisme, qui, sous le prétexte de purger la patrie des superstitions, brisa le trône, campa dans les églises, dans les palais, et fit litière de l'art au pied des chevaux.

Ces années de tourmente, qui, selon les éternels desseins de la Providence, ont préparé la sagesse et la liberté de la nation, furent mortelles à l'art. Les fleurs et les fruits tombent dans les orages. Les douces émotions de l'art ne sont pas faites pour l'orgueil solitaire et farouche des puritains.

Cromwell lui-même, qui, par la puissance et la profondeur de son génie, domina la rébellion, était d'une étroitesse rigide, bien capable de glacer l'imagination de l'artiste : " Faites," disait-il à Pierre Lély—un Van Dyck efféminé—" faites mon portrait avec exactitude et sans flatterie ; remarquez bien mes rugosités, mes bourgeons, mes verrues ; enfin tous les détails de mon visage. Si tout cela n'est pas rigoureusement rendu, vous n'aurez pas un liard."

Un mot d'éloge aux derniers imitateurs estimables de Van Dyck en Angleterre : Dobson et Jameson, vos concitoyens ; l'allemand Kneller, dont le succès dépassa peut-être le mérite ; James Thornhill, qui fut aussi votre compatriote habile, mais énervé par l'imitation des écoles étrangères ; et j'arrive à William Hogarth, qui ouvre la série des maîtres vraiment originaux de la vivante et libre école de la Grande Bretagne.

Quand on examine le portrait de William Hogarth peint par lui-même on retrouve dans les traits de son visage les traits saillants de son génie. Sa physionomie est un composé vivace de pénétration, d'audace et d'ironie. L'œil vif, perçant, d'un gris-bleu translucide, voit tout, traverse tout ; le front est ouvert, tranquille, d'une structure robuste. La bouche ferme, violente, poussée en avant par une forte dentition et par la carrure inégale des mâchoires, indique une immuable tenacité. Cet homme n'hésite pas, ne rêve pas ; il juge clairement. La raison positive, l'expérience de la vie dominent en lui la poésie du sentiment. Chirurgien endurci, il semble attendre le patient, d'un cœur qui ne sait pas gémir et d'une main qui n'a jamais tremblé.

Et malgré tout Hogarth ne manque pas d'une certaine bonhomie : il épie les travers du monde sans colère ; c'est la rectitude de son esprit, c'est la vigueur de sa vocation qui le poussent à les châtier. Railleur et non pas aigre, violent plutôt que haineux, il laisse poindre à travers son austérité des impressions joyeuses et comiques. Sur son visage rayonne le contentement échauffé de malice de l'honnête homme, fier de sa conscience après avoir sondé celle des autres.

Il est bien difficile, messieurs, de signaler une beauté nouvelle dans l'œuvre de Hogarth, commenté par l'univers entier, et dont le fond semble pourtant inépuisable comme le cœur humain. Cet artiste dont le multiple génie réunit les facultés du peintre, de l'historien, du moraliste et du poète dramatique, a compris et rendu les passions d'une manière qui ne sera jamais surpassée. On a essayé, mais à tort, selon moi, de comparer les licences de Hogarth à celles de Boccace. Tandis que le conteur italien se plaît au milieu des vices de son temps, Hogarth ne hante les mauvaises passions de la société que pour en faire la cruelle autopsie. Dans le cours de son œuvre le Mal trouve toujours une mauvaise fin : dans le " Mariage à la Mode," le riche et vaniteux Shériff est puni de son ambition nobiliaire pour sa fille ; le comte débauché meurt du coup d'épée de l'amant Silvertongue, pendu lui-même à Tyburn, et dont la mort fait mourir la comtesse, dont le nouveau-né porte à son tour au front les hideuses traces de la luxure de son père. Le Rake, fils prodigue d'un vieillard avare, commence ses débordements avec les filles, les aventuriers, et les histrions, pour tomber de débauche en débauche, ou plutôt de châtiment en châtiment ; la gêne, la prison, la ruine complète ; le mariage mal assorti pour la réparer, le jeu, qui le replonge dans la misère, les expédients littéraires qui, certes, ne l'en tireront pas ; enfin le désespoir, la folie. La première femme qu'il trompa, et qui a toujours le tort de l'aimer, expie cruellement son dévouement pour un tel vaurien par le malheur de ne pouvoir jamais aimer un autre homme. Que dire du fatal abrutissement de la courtisane, et de son amant, que la paresse et les plaisirs mènent au crime et à la potence ? Ainsi la responsabilité du mal ricoche, dans l'œuvre de Hogarth, le rude justicier, d'un personnage à l'autre, pareille à ces boulets qui, dans les villes bombardées, emportent du même coup hommes, femmes, et enfants.

Physiologiste que rien ne trouble, que rien n'arrête, Hogarth saisit d'un coup d'œil prompt et sûr les caractères saillants du vice ou ses tendances mystérieuses, et l'arrache du cœur de l'homme par une sorte d'opération césarienne. Il voit les instincts poindre dans l'enfance, surgir dans la jeunesse, éclater dans l'âge mûr, et se traîner dans la vieillesse ; il devine l'origine, l'âge, le développement, la destinée d'une passion. Aussi profond, aussi lucide en indiquant le caractère du nouveau-né qu'en exprimant celui du centenaire, il se tient ferme à tous les degrés de l'échelle de la vie, son immortel observatoire.

Quel patient et rusé guetteur de nos plus imperceptibles émotions ! Je ne puis oublier un de ses tableaux, possédé, si je ne me trompe, par Monsieur le Comte de Stamford. Un petit garçon de trois ans et une petite fille, à peine âgée d'une année, s'y trouvent réunis. Le petit garçon tient en l'air, par les pattes de derrière, un chien, né depuis trois ou quatre jours, qui, suspendu dans le vide, la tête en bas, roule douloureusement ses yeux chassieux, à peine ouverts à la lumière, et pousse des plaintes étouffées. Mais le jeune bourreau, qui a déjà cassé tous ses joujoux, s'amuse du supplice de l'innocente bestiole, autre joujou vivant. La petite fille l'approuve de ses yeux pétillants. " Cet âge est sans pitié."

Je ne suivrai pas en détail, Messieurs, l'effrayante logique des misères humaines dans l'œuvre de Hogarth. On y voit dans la série de la " Cruauté" des enfants tourmenter les bêtes, arriver par la suite à égorger l'homme, et, après l'avoir égorgé, s'enivrer encore de l'odeur du sang qui coule de ses entrailles palpitantes. Et quelles nuances intermédiaires l'implacable maître sait établir, d'une extrémité à l'autre de nos violences, de nos vices, de nos faiblesses ou de nos ridicules ! L'armée du Mal est dénombrée avec tous ses soldats et tous ses capitaines. Chacun de ces caractères tranchés est suivi d'une infinie variété de caractères du même ordre, agités à des degrés divers par une même passion. Naturaliste incomparable, Hogarth les fixe à jamais dans ses ouvrages qui sont autant de planches illustratives de la zoologie humaine.

Mais Hogarth ne se contente pas de saisir et de rendre une telle variété de personnages à la façon d'un peintre de portraits dont l'innombrable clientèle comprendrait tous les âges, toutes les conditions, tous les tempéraments. Après avoir analysé l'individu en moraliste, il le met sur la scène en dramaturge ; il en fait un acteur comique ou tragique, par moments tragique et comique à la fois, pour se conformer à cette loi de la nature, qui nous donne en même temps ou successivement, le plaisir et la peine, le rire et les pleurs. La passion particulière de chaque personnage devient générale, typique, dans la généralité de l'action. Ce n'est plus un avare, un hypocrite, un débauché, un assassin ou une prostituée qui pose devant vous ; c'est l'Avarice, l'Hypocrisie, la Débauche, la Cruauté ou la Prostitution incarnée qui vous regarde. L'énergie de chacun de ces caractères est la condensation, le résumé, la vivante algèbre de mille caractères. Par une sorte d'idéalité, qui éclaire et fortifie l'observation positive, Hogarth s'est fait un monde à lui de la quintessence du nôtre. Il pose, il noue, il accélère ses drames suivant l'irrésistibilité des affections humaines, selon la logique fatale des événements ; il les dénoue avec l'implacabilité du destin. La " Vie du Rake," la " Vie de la Courtisane," le "Mariage à la Mode," "l'Histoire des deux Apprentis," sont des merveilles d'entraînement dramatique. Et quelle vigueur! La scène n'est jamais tranquille, le spectateur ne respire pas; la péripétie pousse la péripétie, la physionomie agit sur la physionomie, le geste sur le geste, le caractère sur le caractère; l'action entière s'enflamme, les passions se ruent l'une sur l'autre, comme les bêtes féroces d'une ménagerie. Hogarth les aiguillonne, les exaspère, pour qu'elles s'entredévorent, semblable à un belluaire qui prend lui-même à leur contact quelque chose de leur férocité.

Mais, à travers les tristes déchirements de la vie, l'illustre maître n'a pas oublié les hommes consolants: l'apprenti intelligent et sage arrive à la fortune, à la considération, aux honneurs de la première magistrature de Londres. Comme vous, Messieurs, Hogarth savait récompenser l'intelligence, le travail et la probité. Il honora la charité chrétienne, dans la personne du très généreux et très vénérable Thomas Coram, le fondateur de l'hospice des enfants trouvés, et que j'oserai appeler le Vincent de Paule de l'Angleterre. Et, comme l'admiration des grands caractères porte bonheur à tout le monde, surtout à l'artiste, Hogarth fit un chef-d'œuvre: Le capitaine Thomas Coram est un vieillard aux cheveux blancs, mais robuste et vert comme un chêne, d'une complexion noueuse et carrée, un superbe tronc d'homme d'action. Le travail, la sagesse, la paix du cœur entretiennent à la fois en lui la fraîcheur, l'activité du sang, la plénitude de la santé, l'éclat de la physionomie. Ce vieux marin, l'un de vos meilleurs colonisateurs, passa sa vie à braver les périls de la mer et à répandre ses bienfaits sur la terre. Rudement élevé, loin des oisivetés, des intrigues, des perversités du monde, il garda, sans l'user, son cœur pur, son cœur d'or. Les hommes vraiment forts sont les soutiens des faibles dans les desseins de Dieu: le capitaine Thomas Coram chercha les malheureux et s'oublia lui-même. Après s'être dépouillé saintement de tous ses biens, pour assurer un asile aux enfants innocents, abandonnés par l'amour coupable, il disait, avec une noble fierté, ce que l'homme inutile ou vicieux n'ose pas toujours dire: "Je n'ai pas honte d'être pauvre." Hogarth se montra toujours heureux d'avoir peint un tel homme chez qui vivent en paix la force physique et la beauté morale: *Mens sana in corpore sano.* C'est là le portrait de la Vertu.

Ce qu'il y a de plus extraordinaire dans le génie de Hogarth, ce n'est ni le pouvoir encyclopédique avec lequel il prend isolément ou met en rapport tant de types divers,—c'est la souplesse qu'il a pour passer de l'un à l'autre, du plus élevé au plus bas, semblable au virtuose qui promène ses doigts agiles sur le clavier d'un instrument. Chacune de ses figures est une note aigüe ou un ton grave tiré de ces innombrables gammes morales qui montent ou descendent de l'imbécilité au génie, de la malice à la férocité, du ridicule au sublime. Je ne finirais pas de citer ces physionomies, séparées les unes des autres, par le contraste, ou rapprochées entr'elles par l'analogie. Les agents du Mal sont en majorité dans l'œuvre de Hogarth, ainsi que dans la vie réelle. L'artiste n'a pourtant pas absolument peint le monde tel qu'il est, heureusement pour nous. Il le voit d'un œil irrité. Parfois injuste par excès de justice, Hogarth aime à le surprendre dans la plénitude de son infamie, et à nous convaincre qu'il est toujours le même. Indépendant jusqu'au cynisme, il se plaît à couvrir de la même honte la populace gorgée de gin, les gentlemen ivres de punch, les noblemen coureurs de filles. Il frappe le marchand frauduleux, le prêtre prévaricateur, le mari brutal, la femme corrompue, l'enfant prodigue, le vieillard avare, le maître et le valet, le mendiant et le roi. Il épuise, dans sa guerre contre les hommes, tous les traits de l'ironie et de la colère. Enfin, pris d'une espèce de miséricorde bouffonne, il les conduit, comme un médecin de fous, chacun dans son cabanon. Avec une telle énergie d'humeur Hogarth n'est jamais insipide; mais il tend à l'exagération, et penche quelquefois vers la caricature, qui est l'outrance du vrai. Ses tableaux sont de cruelles satires. Il faut les lire comme nous avons lu celles de Perse, de Juvénal, de Pétrone et de Pope, les scènes mordantes de Shakspeare et de Molière, les chapitres de Rabelais et d'Honoré de Balzac.

A quoi bon relever ici quelques erreurs, quelques préjugés relatifs à Hogarth? Vous en avez fait justice. Il n'excellait, a-t-on prétendu, que dans les types grossiers; mais vous savez bien quelle délicatesse, quel charme ou quelle subtilité il a su donner à certaines figures: la modiste abandonnée, le Comte et la Comtesse de Squanderfield, l'avocat Silvertongue, la jeune fille menée en consultation dans le cabinet du docteur Quack, et tant d'autres qui me rappellent tour à tour la naïveté d'Adrien Ostade, l'esprit de Téniers, le sentiment de Greuze et la finesse de Chardin. Ses crudités, d'ailleurs, sont les surabondances de la franchise, les débordements de la force. Le gros sel de Hogarth n'irrite que les faibles tempéraments. Ses burlesques éclats de rire au milieu des scènes les plus poignantes ont même quelque chose d'étrange qui ajoute au lugubre et augmente la pitié du spectateur, comme les plaisanteries et les chansons des fossoyeurs poussent au noir la tristesse de Hamlet, tenant dans ses mains le crâne du pauvre Yorick, qui berçait et rejouissait son enfance.

Je passerai rapidement, Messieurs, sur l'esthétique et sur l'exécution particulières à Hogarth. S'il n'a point toujours montré aux vieux maîtres toute l'admiration, tout le respect dont ils sont dignes, c'est qu'il est entraîné par la nature vers un but opposé à celui qu'ils ont eux-mêmes atteint ou seulement poursuivi. Son intelligence militante n'était pas faite pour les plus hautes abstractions de l'Art. Sa fameuse "ligne de Beauté" c'est la route sinueuse, serpentine, qui le conduit, non pas à l'idéal plastique, mais au fond du cœur humain, c'est la voie de l'observation positive. Et d'ailleurs, ce n'est pas la grande tradition des maîtres italiens qu'il entend railler, ce sont les amateurs de son temps, moins engoués du mérite de la peinture que de sa vétusté.

Hogarth comprend vîte, réfléchit avant que d'entreprendre, et compose avec habileté. S'il multiplie un peu trop les détails, c'est dans la crainte de ne jamais se faire assez comprendre. Il tient si fort au sens didactique de ses tableaux! Hogarth, que bien des gens en Europe se sont obstinés à considérer comme un simple graveur, est un excellent peintre, ce qui est surprenant chez un homme assiégé par tant d'idées, et ambitieux de les exprimer toutes. Il a toujours quelque chose des maîtres dont le style est exempt d'affectation, des flamands surtout. La série de ses tableaux le plus largement peinte et le mieux conservée, est, à mon humble avis, celle des "Elections," que M. George Bailey, le digne curateur de Soane's Museum, m'a montrée plusieurs fois avec tant de complaisance.

Hogarth ne fut pas dans sa vie exempt d'étroitesses et de préjugés. Pour une simple mésaventure à Calais, il garda rancune à la France, qui ne lui a répondu que par l'admiration; mais il aima son propre pays en lui disant de rudes vérités et en devenant un de ses grands hommes. Avide d'action, dédaignant les rêves et même la grandeur des souvenirs, il fixa les vivants sur la toile au lieu d'évoquer les morts illustres. Il ne sortit pas de la vraie portée de sa vocation, chose que très peu d'hommes savent faire. Il ne s'élève point vers le ciel, mais il marche d'un pas ferme sur la terre; et, comme l'a si bien dit Hazlitt, "Son génie avait des pieds et des mains; il n'avait pas d'aîles."

Hogarth est le véritable initiateur de l'école anglaise qui maintenant excite les sympathies de l'Europe. Walpole fut aussi aveugle qu'injuste en déclarant que "Hogarth n'est pas un peintre;" et Burke lui-même semble avoir partagé cette erreur, en disant que "Reynolds fut le premier Anglais qui ajouta la gloire des arts élégants aux autres gloires de son pays."

Dix années après Richard Wilson, le réformateur du paysage, Reynolds vint à son tour régénérer la peinture, surtout la peinture du portrait, tant affaiblie par les derniers disciples de Kneller. C'est par là qu'il mérite aussi le nom de fondateur. "Nos peintres," disait-il, "ont adopté une pose qu'ils donnent indistinctement a toute personne, ce qui fait que toutes leurs peintures se ressemblent. S'ils ont un sujet historique, ou une famille a représenter, ils recherchent tout d'abord dans leur livre de croquis des têtes prises aux divers tableaux ; ils ne se donnent pas la peine de penser eux-mêmes." Reynolds, au contraire, pensait beaucoup, et pensait juste. De là ses efforts, ses succès, son autorité durable. Il sût donner à ses ouvrages l'empreinte du génie nourri par l'étude et fortifié par la volonté. Les passages les plus judicieux et les plus éloquents de ses discours sont également médités. A la manière des orateurs de son temps, dont il était l'ami, Reynolds, dans ses opinions comme dans ses peintures, frappe d'autant plus fort qu'il mesure plus longuement ses coups; et vous savez mieux que moi, Messieurs, que ses effets ne manquent pas d'énergie. Ils semblent parfois en avoir trop. L'abondance vivace de Rubens, la magique lumière de Rembrandt, la simple et forte majesté du Titien, l'élégance de Van Dyck, la fine variété du coloris de Véronèse, le tourmentent à des degrés divers, et telle Sybille de Michel Ange semble lui apparaître au moment même où il commence le portrait d'une lady. Mais une véritable force intérieure le retient sur la pente de l'imitation, et les réminiscences enthousiastes restent à son profit au lieu de tourner à son détriment. Le génie,—Reynolds l'a dit lui-même,—ne peut tout deviner, tout créer par la seule vertu de son innéité : il a besoin, pour éclairer sa route, de toutes les lumières de la tradition. L'Académie Royale de Londres doit au savoir et à l'expérience de Sir Joshua Reynolds, son premier président, cette dignité intellectuelle qu'elle montre encore aujourd'hui sous la présidence de Sir Charles Eastlake. Les discours de Sir Joshua, plusieurs fois traduits en Français, sont de la plus haute valeur. On y sent en même temps le théoricien et l'exécutant se prêter un mutuel appui et quelque fois se contredire. Il y a, par exemple, d'excellentes reflexions sur l'effet, que Reynolds rend le plus souvent à merveille, et des préceptes contestables sur la composition, qui, chez lui, n'est pas toujours heureuse. Il a démontré le clair-obscur des Vénitiens d'une manière très simple et trop rabaissé leur école dont il a du reste beaucoup tiré. Son amour pour l'ecclectique sagesse des Carraches n'est pas plus passé dans ses peintures que son enthousiasme pour Raphael. Reynolds est pourtant un grand artiste. Son nom ne peut manquer de venir toutes les fois qu'il s'agit des maîtres qui ont excellé dans le portrait ou dans la peinture à effet: Rubens, Van Dyck, Rembrandt et Murillo.

Le portrait de Nelly O'Brien,—cette belle et indolente héroïne de la chronique scandaleuse du dernier siècle,—me semble le plus original et le plus parfait en son genre des ouvrages de Reynolds ; il ne perdrait peut-être rien de son charme à côté du fameux *Chapeau de Paille* de Rubens, une véritable fleur humaine, qui boit la lumière du ciel. Dans un ordre plus grave, les portraits de l'artiste peint par lui-même, de l'Archevêque Robinson, de Sir William Chambers, de Lord Heathfield, du docteur Hunter sont vraiment admirables par la finesse ou la fermeté du caractère, la vérité de l'attitude et la puissance de la couleur. J'en passe, et des meilleurs ; Reynolds en a tant fait que ma mémoire en est quasi troublée. Dans un genre peut-être plus intime et plus piquant à la fois, voyez Mistress Anderson Pelham, qui donne à manger à ses poules, et dont l'ajustement capricieux vous séduit ; la Vicomtesse Lavinia Althorp qui a tant d'élégance et d'esprit ; l'aimable et vive famille Braddyl, dont on croirait entendre la conversation familière. Dans l'ordre de la fantaisie l'on ne peut oublier *Robinetta* et son oiseau; *Puck* assis sur son champignon avec tant de malice ; "l'Ecolier dessinateur," qui rappelle un peu trop directement Rembrandt; "l'Enfant Contemplatif," dont l'expression est si profonde, la couleur si variée et d'une tonalité si vibrante. Parmi les portraits changés en allégories, quelle audace, quelle splendeur pittoresque dans la tournure de la Muse tragique de Dulwich College, assise avec un calme si violent entre l'Empoisonnement et le Meurtre, ses cruels conseillers ; quelle verve opulente dans la figure d'Emilie Bertie qui, malgré ses formes tournées au style statuaire, se détache superbe, menaçante sur un ciel remué par les flammes et les fumées de l'incendie. Par son effrayante harmonie composée de vapeurs noirâtres, verdâtres et sanglantes, ce ciel de Reynolds me rejette dans ces fortes impressions morales que j'ai si souvent éprouvées devant les ciels d'Eugène Delacroix, notre immortel peintre français, qui, de même que Reynolds l'a voulu faire ici, renforce l'expression des passions humaines en remuant autour d'elles la physionomie de la nature extérieure. J'allais oublier "l'Ugolin," toile sinistre, devenue célèbre dans le monde entier, et l'ébauche de la "Mort du Cardinal de Beaufort," ébauche surprenante, dont les touches ressemblent à des fulgurations. Bien que Reynolds soit ordinairement contenu par sa forte volonté, il semble par moments emporté par l'ardeur intérieure. De là quelques relâchements de forme ; de là cet usage excessif des bitumes, qui, en chauffant la vigueur de l'effet, le poussent au noir par la suite ; de là aussi cet emploi rapide des vernis siccatifs, qui, en abrégeant les irritantes lenteurs du métier, compromettent la conservation des tableaux. Reynolds regagne par l'aspect général de ses ouvrages tout ce qu'il peut avoir perdu du côté du fini, et, comme Rembrandt, il peut dire : "Je cesse de peindre quand j'ai cessé de penser."

Oui, Reynolds est un grand maître, et son image est digne de figurer avec celles des maîtres immortels à la galerie de Florence. C'est Reynolds, c'est lui, qui, le premier, apporta dans votre école nationale cette largeur de style qui donne l'apparente fougue de l'improvisation aux tableaux les plus travaillés ; cette souplesse de modelé, cette hardiesse de contours qui rendent les figures si saillantes et leurs mouvements si libres ; cette façon voltigeante des draperies qui allège et ennoblit la tournure ; cette transparence dans le fond du sujet, dans le paysage qui fait, pour ainsi dire, respirer aux êtres imaginaires l'air vivant de la nature.

La peinture de paysage était tombée en Europe entre les mains des maniéristes. Celui d'entr'eux qui, en Angleterre, poussait le plus loin possible l'absurdité de l'imitation, c'était Wooton. Il mettait les gentlemen en jacquette et en grandes bottes avec leurs meutes et leurs chevaux dans des sites empruntés du Guaspre. Richard Wilson ne revenait pas d'Italie pour continuer précisément en Angleterre la tradition classique, dont on avait déjà tant abusé en l'affaiblissant, mais pour essayer de la raviver par ses impressions personnelles et par l'étude attentive de la nature de son propre pays. Il n'était pas, à la vérité, animé de ces fortes ardeurs qu'il faut à l'artiste pour remuer les autres hommes, mais il avait, en revanche, un talent élevé, doux, sincère et beaucoup d'expérience traditionnelle. Wilson, en conservant, à certains égards, son originalité, n'oublia jamais ni Claude Lorrain, ni le Poussin; et le solennel reflet des campagnes romaines s'étend sur la plupart de ses ouvrages. Il poursuit la grande combinaison des lignes, la silhouette monumentale des objets, la majesté de l'échelonnement des plans, l'aspect décoratif des fabriques, des ruines, des chaînes de montagnes noyées dans les teintes mourantes de l'horizon. Les sites, illustrés par la présence des grands hommes, appelés paysages historiques, tourmentent son génie tranquille, qui se fût peut-être plus heureusement développé au sein de la nature anglaise, si chère aux peintres coloristes et aux caractères rêveurs. Ostade, Cuyp, Ruysdael, Hobbéma, ne sont probablement devenus de si grands maîtres que par le seul fait d'être restés fidèles à leur pays natal. S'ils n'ont rien de ce faux éclat que les voyages donnent à quelques maîtres touristes, quelle puissance d'intimité n'ont-ils pas tiré de la contrée qui les vit naitre, vivre, et mourir? Et, ce qui sauve, aujourd'hui même, l'originalité de vos peintres en excursion sur le continent, c'est qu'ils y gardent au fond du cœur la vivante image de l'Angleterre.

Nous avons beau aller de nation en nation, errer de soleil en soleil, notre pays ne perd jamais ses droits sur nous; nous revenons, avec un plaisir infini, des extrémités du monde dans la ville, dans le bourg qui nous a vu naître; bienheureux l'homme qui, après les agitations de la vie, peut trouver sa tombe dans le lieu même où fut son berceau ! Bien que Wilson ait montré, à travers quelques réminiscences de Claude, une véritable noblesse d'effet, et toutes les tendances d'un génie élevé dans ses "Vues d'Italie," principalement dans "La Villa de Cicéron," je l'aime mieux encore dans des sujets plus familiers, dans quelques "Vues de la Tamise et du pays de Galles." Sa "Vallée de Llangollen" charme les yeux et entraîne le cœur. On se repose avec délices au bord de ce lac tranquille, alimenté par le torrent qui descend des montagnes dont les mamelons s'effacent insensiblement dans les vapeurs de l'atmosphère. Autour du lac limpide et dormant s'étend un liserai de prairies animé par quelques bestiaux. A droite et à gauche s'élèvent des mamelons aux flancs obliques, étagés de chaumines, et ombragés d'arbres très fins et très beaux, qui ne viennent jamais si bien que dans ces endroits abrités.

Wilson n'éprouve ni ne fait guère sentir la chaleur. Il fait chaud dans "l'Effet du Soir," pris dans les environs d'Eton, une de ses plus belles peintures, bien qu'elle ne soit pas exempte de convention classique. Dans la "Vue de l'Arno," le soleil italien luit sur les rives du fleuve comme à travers un papier huilé. Dans la "Vue de la Tamise près de Marble Hill," petit tableau, fort original et très librement fait, la scène, d'une harmonie de couleur bleue, verte et grise, est éclairée, pour ainsi dire, par une lumière boréale qui donne froid aux os. L'artiste semble répandre sur la Nature la tièdeur de son âme ou la froideur de ses découragements. L'aspect du monde est égayé par nos joies ou assombri par nos douleurs. Le cœur de l'homme est un miroir brillant ou dépoli. Ordinairement privés de ces contrastes de lumière et d'ombre, de ces caprices de nuages qui, par la suite, ont ajouté tant d'effet poétique aux tableaux de Turner et de Constable, les ciels de Wilson paraîssent monotones, languissants, étouffés. Mais l'orage qui éclate dans la "Mort des Enfants de Niobé" retentit dans l'âme du spectateur, comme l'hymne du *Dies iræ*, dont chaque strophe est une nuée menaçante, un éclair ou un coup de tonnerre.

Mais Wilson semble surtout se complaire dans l'expression calme, mélancolique, et solennelle de la nature. Il n'a ni ruses, ni affectations, ni petitesses, ni dissimulation pour nous plaire. Son cœur répond avec la fidélité d'une cloche à tout ce qui vient de le frapper. Ses moyens pratiques sont très larges si l'on veut considérer surtout les procédés en vogue de son temps. Sa touche est libre, courante et sûre. Rien de pointillé en vue de la perfection trop souvent mesquine du beau fini. Les ombres qu'il étend à l'entrée de ses tableaux, pour rendre plus sensible la lucidité des fonds et faire reculer l'horizon, sont des repoussoirs qui arrêtent quelquefois le spectateur. Il y a du grandiose dans la physionomie de ses rochers, du caractère dans la tournure de ses collines, du pittoresque dans les phares ou dans les tours en ruines qui les couronnent. Ses vieux troncs d'arbres sont cassés à la façon de Salvator Rosa; secoués par l'orage à la manière du Poussin; tranquilles sous le ciel, dans le style de Claude; morts, excoriés, étendus sur la terre, comme on les voit dans les tableaux de Wynants. Wilson montre particulièrement son originalité dans l'abondance par moments pesante avec laquelle il peint les plantes et les grandes masses de verdure. Son feuillé, très empâté, semble, dans quelques uns de ses ouvrages, sculpté ou brodé à l'aiguille, tant il est modelé en pleine pâte, et tant il a de relief sur le ciel. Mais je me rappelle un arbre à tige grêle, un bouleau à panache affaissé et mourant, qui se détache avec une élégance et une légèreté admirables sur le fond d'un petit paysage, dont j'oublie le nom, et qui fut peint pour le célèbre docteur Hunter. Quand il s'abandonne aux impressions de la nature anglaise, Wilson nous fait penser parfois à Hobbéma par l'élegance d'embranchement qu'il donne aux arbres, par la manière charmante dont il sait les grouper, en dépit de la loi classique, et par les teintes bleuissantes qu'il étend à travers leurs troncs et leurs frondaisons. Mais cette harmonie bleuâtre est commune à tous les peintres du Nord. Elle n'a rien d'arbitraire dans l'art, puisqu'elle frappe à tout moment dans la nature les yeux du voyageur le moins attentif. L'admirable Gainsborough la sentait si vivement qu'il me semble l'avoir rendue avec une certaine exagération. Si, dans l'œuvre de Wilson, les objects les plus légers, les feuillages, par exemple, ont trop de consistance, les corps solides, les terrains, n'en ont pas assez. Les eaux sont belles, transparentes sous la lumière, quelquefois épaisses du côté de l'ombre. Wilson aime surtout la nature au moment où les végétations prennent les teintes mêlées de l'automne. C'est alors que la campagne prend son air le plus doux, le plus mélancolique, le plus religieux. Wilson y promenait ses chagrins avec une amère volupté. C'est le peintre de la chûte des feuilles.

Il suffit de voir à l'Académie Royale le portrait de Gainsborough peint par lui-même pour bien connaître son caractère et pour dire de lui: "Nature riche et tendre, âme subtile et douce, homme exquis, né pour jouir et souffrir de tout avec une délicatesse et une profondeur infinies!" On le sent vivre. Toute sa personne respire la noblesse innée, l'aristocratie de l'intelligence et du cœur, la seule véritable. Aimable et beau à se faire suivre, il est bien anglais par la limpidité du sang; on le dirait allemand à la douceur de quelques airs de tête, français par la vivacité de la physionomie. Un charme inexprimable rayonne sur son visage. Ses yeux profonds cherchent à la fois au dehors et au dedans d'eux-mêmes, comme s'ils étaient doubles, vaguement suspendus entre le monde physique et le monde moral, entre l'observation et le rêve. Ces yeux magnétiques participent, en quelque sorte, au sens de l'ouïe tant ils sont chargés d'attention; l'artiste vous regarde et semble écouter en même temps les notes mourantes d'une mélodie lointaine ou les bruissements intérieurs de sa propre pensée.

L'exécution de ce portrait est enlevée avec l'aisance et la simplicité habituelles de l'artiste. C'est l'innéite du génie jointe à l'habileté pratique, habileté qui ne paraît presque pas tant elle est parfaite. Thomas Gainsborough produit ses ouvrages comme un arbre porte ses fleurs et ses fruits. Et ces ouvrages faciles vous pénétrent à tel point que l'on ne les oublie jamais. Gainsborough est doué, même dans ses peintures manquées, d'un charme irrésistible. Et le charme naturel chez l'artiste est une qualité supérieure à la force. Les cœurs viennent à lui par entrainement, ce qui le dispense des efforts et des soucis de la domination. Les maîtres plus savants et plus austères que ne l'est Gainsborough ne peuvent lutter contre lui. Dans leurs ouvrages on est à l'école; dans les siens on est à la fête.

Voici "l'Enfant Bleu," qui du fond de la toile semble venir à vous. Son bras gauche ployé tient relevé sur la hanche son élégant manteau; le bras droit pend avec souplesse le long du corps; la main tient un grand feutre noir à plumes blanches; les chausses sont fixées au genou par une jarretière moirée à crépines d'argent; le bas de soie est bien tiré sur cette jambe fine; son petit pied se cambre dans un soulier à grands nœuds de rubans. Ce doux visage est encadré par une fraise brodée à jour. Pas un prince ne l'emporte en noblesse et en grâce sur "l'Enfant Bleu," qui, pourtant, n'est qu'un enfant du peuple, idéalisé par le peintre. L'art ennoblit tout ce qu'il touche. Et que l'on sent bien ce corps palpiter et saillir sous ce charmant costume! La lumière le caresse obliquement; le côté droit de la poitrine se modèle en tournant, la jambe droite s'efface, la gauche se prononce; la silhouette générale du corps est noyée dans l'atmosphère avec une douceur, une subtilité dont il serait difficile de trouver un pareil exemple dans l'œuvre entier de Van Dyck. Gainsborough ouvre derrière "l'Enfant Bleu" toute la profondeur d'un paysage, et, bien que rien n'y soit déterminé ni dans le ciel ni sur la terre, la simple ébauche parle ici beaucoup mieux que ne le pourrait faire une peinture achevée. Le soleil va s'éteindre dans les vapeurs du crépuscule. L'Enfant s'arrête, gagné par la tristesse du soir qui commence à descendre sur la campagne. L'harmonie de la couleur bleue prise par Gainsborough, en contradiction des préceptes de Reynolds, n'a rien de froid, rien d'insolite. Van Dyck, si je m'en souviens bien, nous l'a montrée avec bonheur dans la figure allégorique de la Duchesse de Southampton. L'Enfant, tout vêtu de satin bleu, serait, pour ainsi dire, isolé dans le fond du paysage, qui est d'un ton chaud, si l'artiste ne l'y rattachait par les teintes bleuâtres répandues autour des arbres et dans les nuages. La foule se pressait tous les jours, à l'Exhibition de Manchester, devant cet admirable tableau, obéissant à son insu à l'irrésistible attraction d'un chef-d'œuvre à la fois naïf et raffiné, inexplicable comme la séduction.

Gainsborough comprend la femme avec une finesse de coup-d'œil et une délicatesse de cœur que Van Dyck, Reynolds et Lawrence ne me paraîssent pas avoir au même point que lui. Il nous dit tous les secrets de son caractère et de sa beauté: impressions, ruses, caprices, bouderies, violences et tendresses, gestes, maintien, démarche, coquetteries et grâces félines. Il fixe sur la toile le velouté de pêche, les érubescences délicates, les bleus tendres ou meurtris du teint de la blonde; les tons verts, jaunes et bistres. qui luttent ardemment dans le teint de la brune, et il nous fait sentir, d'une touche légère comme le coup d'aîle du papillon, l'imperceptible duvet qui ombre son visage. L'artiste qui sait bien tout ce que la femme, en apparence la plus naïve, peut mettre de savoir subtil dans sa familiarité et dans son abandon ne l'observe pas seulement, il la devine. Aussi pose-t-il sa tête, son corps, ses pieds, ses mains avec une merveilleuse finesse d'intention qui n'appartient qu'à lui et qui ne blesse ni le naturel ni la simplicité. C'est dans ce sentiment exquis qu'il me paraît avoir peint Mistress Graham, aux lèvres de cerise, aux carnations fleuries, et dont la riche et capricieuse toilette est le chef-d'œuvre du dandysme féminin. Mais je préfère à tant d'éclat l'intimité du portrait presque détruit de la célèbre Mistress Siddons, dont la toilette de ville est la plus piquante expression du simple dans l'étrange.

Gainsborough a trop d'esprit pour donner la moindre enflure à ses personnages illustres. Il honore, au contraire l'intelligence en respectant le naturel dans sa physionomie. Le portrait de Garrick passe pour être manqué; mais, à la façon dont le célèbre acteur tient son livre ouvert, à sa manière de regarder, de sourire et de s'accouder, nous voyons le fond de son humeur, nous suivons le tour de ses pensées. Cette délicatesse, cette subtilité de l'observation du peintre, ajoute non seulement à l'esprit, à la grâce, mais encore à l'énergie du sujet. William Pitt, violent et rude dans la toile de Hoppner, me paraît beaucoup moins redoutable qu'il ne l'est dans celle de Gainsborough, qui a compris et rendu son caractère avec une véritable acuité morale.

Que Gainsborough est émouvant par ses paysages! Tout entier aux impressions de la nature, de la nature de son pays, il ne sent ni les conventions, ni la plus légère influence d'école. Si, par hasard, il paraît ressembler à Rubens, à Cuyp, à Huysmans de Malines, ce n'est que par analogie de tempérament, analogie bien passagère; il ne relève en réalité que de lui-même. Quel génie! Quelle tendresse de cœur! Il embrasse l'homme, les animaux, tout ce qui vit, tout ce qui respire, de son immense sympathie. Voyez ces deux jeunes mendiants errant à l'aventure. L'un lève les yeux au ciel, comme pour implorer le pain de chaque jour, et sa main maigrelette retombe découragée. Son vif chagrin s'avive de la douleur du petit frère qui le suit. C'est ainsi que le conteur Perrault nous montre le petit Poucet et ses frères, abandonnés dans la forêt par des parents trop pauvres pour les nourrir. Le peintre anglais et l'écrivain français ont également exprimé la touchante détresse de l'enfance. Le chef-d'œuvre de l'un est comme le chef-d'œuvre de l'autre, un cri du cœur, une plainte de la nature.

Gainsborough nous pénètre encore ici à tel point de sa propre émotion que nous oublions la beauté du paysage, les bords charmants de cette rivière ombragée, pour suivre le long du sentier les trois enfants du cottage, qui vont à la corvée. Le plus jeune accable de son poids la petite fille qui le porte dans ses bras comme une mère. On les plaint, ces pauvres petits: leur chaumière, qui fume là-bas, a l'air bien délabrée; la misère l'habite. L'amour du plus beau site semble s'effacer dans le cœur de l'artiste dès qu'un être vivant apparaît à ses yeux. Ce qui le frappe surtout c'est l'homme. Il a même à l'égard des bêtes quelque chose de la vive sensibilité de Sterne. S'il met deux chiens aux prises, les larmes roulent dans les yeux du pâtre dont le chien est battu, et c'est à peine si l'artiste peut exprimer la brutalité du chien victorieux et la satisfaction de son maître.

Il choisit d'une manière admirable ses sites sans avoir l'air de les chercher. Ordinairement ce sont de doux abris, ombragés de grands arbres, éclairés par un ciel tranquille. Si le peintre soulève quelquefois l'orage, il paraît laisser aux laboureurs, aux bergers, aux troupeaux, le temps de regagner la ferme. Rien ne trouble, rien n'épouvante les êtres pacifiques qui vivent au bord de ses ruisseaux ou qui se reposent au fond de ses chenaies; les endroits qu'ils ont à traverser ne présentent ni escarpements dangereux ni halliers déchirants. Tout est bonté, mansuétude, poésie dans la nature de Gainsborough, sur ces pelouses rafraîchies par des sources vives; dans ces prairies bordées de vieilles saulées; au bord de ces rivières retentissantes du tic tac des moulins; sur ces collines couronnées d'arbres à hautes tiges, à riches frondaisons, immenses parasols de verdure remués par le vent. Par moments l'uniformité du ciel bleu est seulement coupée par des flocons de nuages blancs, chargés d'une vive lumière; une teinte d'azur enveloppe la masse des végétations, inonde le lointain avec cette exagération de teintes si familière à Breughel et à Paul Bril, que l'on pourrait surnommer les peintres bleus des Flandres. Dans les matinées humides, ses arbres sont enveloppés de vapeurs grises et fumantes, qui cèdent encore au teintes bleues à mesure que le ciel s'éclaircit, que la lumière du soleil se dégage et s'étend. Gainsborough suit enfin les phases changeantes du ciel, mais il en affecte rarement les aspects violents. Une fantaisie particulière à l'artiste, qui contraste avec la fraîcheur naturelle du paysage anglais, et que, du reste, les flamands et les hollandais poussent si loin, c'est une harmonie fauve d'une chaleur extrême.

Gainsborough peint les bêtes non pas avec l'application pratique, mais avec le sentiment rêveur de Paul Potter. J'ai vu dans un petit tableau du maître anglais quelques bœufs d'une physionomie grandiose vaguement arrêtés à la pointe d'un promontoire qui surplombe la mer. Humant l'air salé, ils allongent leurs têtes pensives, et plongent dans la profondeur de l'horizon de grands yeux étonnés, saisis par cette terreur de l'infini que la mer et le ciel confondus font éprouver à l'âme immortelle de l'homme et à l'âme innommée des animaux.

Parfois une joie universelle chante dans les paysages de Gainsborough, et monte de la terre au ciel avec les alouettes vives dont les petits cris percent les brumes.

Gainsborough, dans le paysage surtout, est un improvisateur, qui enlève le sujet sous le feu de l'impression. Aussi ses tableaux ont-ils l'air d'esquisses faciles et courantes. Et c'est précisément ce large "non fini," qui, à distance, en fait la vérité, le charme. Gainsborough se livre à son propre cœur, et laisse son pinceau couler de source. Il ne cherche pas à frapper de grands coups, à l'exemple de certains génies laborieux et pleins de préméditation; et par cela même il les frappe. La douce châleur de son âme passe dans la nôtre; ses pleurs nous font pleurer.

Au plus fort de sa misère, au plus fort de ses emportements qui éloignèrent de lui ses amis, Burke lui-même le plus patient de tous, James Barry, dont les ouvrages décorent cette enceinte, fut le protégé de la Société des Arts, qui ne tient jamais rigueur à quiconque pense et parle librement, tant elle-même se sent forte de sa propre indépendance. Barry voulait faire mentir Montesquieu et Winckelmann, affirmant l'un après l'autre que le génie est une question de latitude. Il réfutait leurs arguments par les exemples de la Grèce et de l'Italie, où l'art est mort, bien que les splendeurs de la nature y restent immortelles. Barry eut peut-être le tort de vouloir inculquer d'autorité à ses concitoyens des sentiments et des croyances. Si l'éloquence des convictions personnelles entraîne d'ardents prosélytes, elle ne bouleverse pas en un jour les traditions d'un peuple. Mais il y a quelque chose de respectable et de touchant dans l'erreur même d'un artiste qui croyait sacrifier sa vie à la Vérité. Son idée fixe fut de faire sentir à son siècle la vanité de l'Art quand il n'est pas absolûment appliqué à l'expression des idées sociales et religieuses. Par cette affirmation, ne semblait-il pas détruire lui-même l'Art qui ne peut vivre que de la liberté, de la variété de ses impressions? Et d'ailleurs Barry n'en proscrivait-il pas les charmes dans ses propres ouvrages par l'ascétisme de la couleur et par la suppression de l'effet, effet qui a tant de puissance sous le pinceau des maîtres coloristes? Vous le voyez, Messieurs, ces compositions sont noblement conçues et puissamment tracées, mais la couleur en est sèche et morne.

C'est ainsi que nous avons vu aussi en France les derniers disciples de Louis David, exagérant son despotisme sans le compenser par aucune de ses grandes qualités, poser en principe le culte exclusif de la forme humaine et chercher à faire prévaloir la beauté de la combinaison des lignes ou contours du dessin proprement dit. Il n'y a pour eux ni caractère, ni grand style hors de l'imitation des types nus ou drapés empruntés à la statuaire, aux fresques, aux vases d'Herculaneum et de Pompéi, aux ouvrages de Raphael; comme si le style pouvait être une pure convention d'école et non l'expression originale et libre du sentiment particulier à chaque maître! Ils ajoutaient que les effets de la lumière, la couleur et le sentiment du paysage diminuent l'importance de la forme humaine, et la réduisent à un aspect indéterminé ou à une sorte de vérité vivante tout-à-fait vulgaire, agréable peut-être aux yeux, mais contraire à l'imagination qui fuit la réalité.

Vous, Messieurs, qui avez eu et qui avez encore de grands coloristes dans votre école, vous savez bien que la Beauté dans l'Art ne provient pas exclusivement de l'agencement linéaire,mais aussi de l'harmonie et de l'effet de la couleur; que la sécheresse des contours tend même à la détruire; que la Beauté humaine résultat expressif de l'agitation physique et des affections de l'âme, au lieu d'être emprisonnée étroitment par des lignes, nous est sensible par sa mobilité même, vue à travers le prestige de la lumière, prestige sans lequel il ne saurait y avoir après tout ni peintre ni spectateur. Vous savez qu'il est impossible de bien rendre le relief, le mouvement des corps sans la combinaison juste et savante des tons de la couleur. Vous reconnaissez à la vue des magnifiques marbres du British Museum que la statuaire antique elle-même doit plutôt sa grande tournure à la saillie, à la largeur de ses plans qu'à la circonscription de ses lignes. En imposant à son époque l'imitation de types invariables empruntés du passé, Barry contrariait la nature, variée à l'infini suivant les temps, les lieux et les races, et, quand il niait la couleur, il abolissait à demi la Peinture.

Je m'honore d'avoir en France pour ami, un illustre artiste, qui, par son mépris de la couleur, se serait bien entendu avec Barry, et qui eût excité la jalousie de Fuseli par son enthousiasme pour Michel-Ange: c'est M. Paul Chenavard, chargé, il y à quelques années, de la décoration du Panthéon de Paris, et dont vous aurez pu voir les Cartons à l'Exposition Universelle de 1855. Il pense, avec Barry, que l'art a pour unique mission de représenter les faits héroïques et d'exprimer les idées sociales. Seulement, au lieu d'affirmer, à la manière de votre illustre compatriote, la loi du progrès humain, il en professe la négation absolue.

Barry nous représente ici l'homme à l'état sauvage, et il le conduit par degrés au Bonheur. Mais l'artiste, malgré sa haute intelligence, n'y est pas lui-même arrivé. La vie de l'homme sauvage que je vois là sur cette toile, adouci par la lyre d'Orphée, ne vous semble t-elle pas préférable à l'existence désolée de cet âpre génie? Non, Messieurs, non, les lumières de la civilisation ne font pas toute notre joie; elles descendent quelquefois dans notre esprit suivies par la grande ombre de la Mélancolie. Heureux les hommes simples, préservés de l'orgueil et des découragements du savoir par l'amour de la nature, la tendresse des affections privées et la naïve admiration du Beau.

L'antiquité, me disait naguère un français, fut pour John Flaxman une fontaine de Jouvence. Il s'y plongea. Génie plein de noblesse, de réflexion, et soutenu par un grand savoir, votre immortel compatriote tient le milieu dans la tradition de l'art européen entre le sculpteur Canova, homme de sentiment, et le peintre Louis David, homme de volonté. Un artiste qui jouit en France de la plus grande renommée, M. Ingres, est à la fois l'élève de Louis David et de John Flaxman. Les vases étrusques et la sculpture des Eginètes donnèrent à Flaxman de très belles inspirations. Il a apporté dans l'art renouvelé de l'antique une extrême simplicité, peut-être inconnue avant lui, simplicité qui, en favorisant la grandeur du sujet, prouve l'élévation de l'intelligence et la perfection du goût de ce noble artiste.

L'œuvre de Thomas Lawrence est le bouquet des fines fleurs de la beauté. Heureux génie! A l'âge où les plus grands peintres luttent contre les difficultés de l'Art et contre l'indifférence de l'opinion, il était l'idole de son temps, l'enfant gâté de la Fortune. On dirait que le reflet de la prospérité de l'artiste éclaire le visage de ses modèles, qui déjà sont les heureux du monde. Reynolds accuse à divers degrés le caractère des passions; Lawrence en adoucit, en dissimule l'expression, et tel est son amour pour la jeunesse et la fraîcheur, que son pinceau répugne à retracer sur le visage des vieillards les effets naturels de l'âge. Avec quelle subtilité il évite la sécheresse des rides et l'affaiblissement des chairs dans l'admirable portrait de l'architecte John Soane, que le fidèle Jackson n'eut point ainsi osé rajeunir! Lawrence était donc né le peintre des femmes. Par la merveilleuse finesse de son dessin, l'éclat, la fraîcheur de sa couleur, la suavité de sa touche; par le sentiment exquis de toutes les délicatesses, de toutes les élégances, Lawrence a surpassé parfois Van Dyck lui-même. Les femmes de Van Dyck posent tranquillement devant nous; celles de Lawrence nous interrogent de leurs yeux brillants et nous parlent de leurs lèvres fraîches et entr'ouvertes. Peut-être Lawrence a t-il recherché quelques moyens d'effet à la Reynolds dans le portrait de la Comtesse de Derby, qui se promène en robe blanche garnie de fourrures, au milieu d'un parc verdoyant; dans celui de Lady Leicester, debout, environnée d'Amours, sur des nuages remuants. Mais, quelle grâce, à la fois simple, éclatante et robuste, dans le portrait de Mistress Siddons, toute pensive, la main suspendue aux feuillets du livre dont la lecture l'a touchée. C'est particulièrement à l'un de ces effets dont je parlais à l'instant que le portrait de Kemble dans le rôle de Hamlet nous frappe, malgré la langueur de la physionomie, qui est loin d'exprimer l'apreté morale du héros de Shakspeare. La douleur, au lieu d'amollir son caractère, le fortifie, lui donne quelque chose d'astringent dans le drame du poète. Dans la peinture de Lawrence, Hamlet manque de nerf et de stoïcité. Considéré comme un simple portrait de Kemble, il manque même d'accent. Et, malgré tout, belle peinture! Hamlet est debout dans le cimetière, les bras pendants, les yeux pleins de pensées. Ce grand manteau de fourrures, doublé de rouge, sur lequel une lumière morne vibre tristement, ces cyprès dont les flèches s'élancent dans les obscurités du ciel, sont des moyens un peu mélodramatiques mais frappants. Hamlet porte des insignes d'honneur qui ont aussi leur éloquence au cou de ce prince, songeant aux vanités humaines sur la tombe d'un fou.

Ces intentions révèlent chez Lawrence une imagination poétique capable de lui inspirer des ouvrages de l'ordre le plus élevé. La vogue l'attacha pour toujours au portrait, genre très périlleux qui pousse l'artiste a faire aux gens du monde, avides de flatterie, d'énervantes concessions. Si Lawrence eût peint, dans toute la liberté de son tempérament, à la vérité un peu tiède, mais très noble et très riche, il eût montré plus d'abondance, plus de caractère, et surpassé Reynolds et Gainsborough à la fois. Mais non, le sentiment lui manquait. D'un autre côté, il avait, pour les hautes régions de la société, ce goût excessif des grands hommes qui sont sortis du peuple. Il sacrifia le beau, rarement compris, au joli, toujours admiré. Il voulut plaire à tout prix et ne connut jamais d'autre souffrance que l'excès même du bonheur. Pris, vers la fin de sa vie, de la satiété du succès, maladie d'autant plus aigüe qu'elle est plus rare, il promena jusqu' à son dernier jour sa tristesse et son ennui. Ses portraits du Pape Pie VII et de Maître Lambton, qui furent tant vantés à Paris, ont fait dans l'art de ce siècle une révolution, et le sourire de ses ladies a pris dans l'histoire une date immortelle. Lawrence est le vrai créateur du portrait moderne, le glorificateur de la beauté des femmes d'Angleterre.

David Wilkie transcrit les personnages sur sa toile avec la fidélité d'un objectif. Une figure de Hogarth est le portrait d'une passion. Une figure de Wilkie est le portrait d'un individu. Hogarth peint ce qui le frappe pour en tirer un enseignement; Wilkie peint ce qu'il voit pour nous amuser et nous plaire. L'œuvre de Hogarth est une histoire morale; l'œuvre de Wilkie est une chronique familière. L'un parle à la pensée; l'autre s'adresse aux yeux. Avec des types anglais, Hogarth nous fait connaître l'homme de tous les temps et de tous les pays; avec les mêmes types, Wilkie donne au voyageur qui passe la physionomie de sa nation. Hogarth est en même temps un psychologue et un peintre; Wilkie est un peintre, un excellent peintre seulement. Il pousse encore plus loin que ne le fait Hogarth la vérité des physionomies; mais ses figures, au lien d'exprimer une idée, expriment une sensation passagère. Un homme tousse, rit ou boit: Wilkie le fait tousser, rire ou boire avec un naturel parfait; voilà tout. Il est de beaucoup supérieur à Hogarth par l'exécution; encore Hogarth me plaît-il d'avantage par son ampleur, et même par sa négligence. Mettez le "Violoniste aveugle" de Wilkie à côté "du Repas des élections" de Hogarth, et vous verrez la différence. Wilkie est de l'aimable famille de Téniers; mais il surpasse le flamand par la patience de son travail et par l'intensité qu'il donne à la couleur. Wilkie médite profondément et dispose avec ordre ses compositions les plus populeuses, tout en les scindant par épisodes; Téniers éparpille avec un certain désordre la pluspart de ses sujets.

Les tableaux de Wilkie sont des compte-rendus, des procès verbaux de ce qui se passe dans l'intérieur ou dans la rue: écoutez un homme curieux, attentif, minutieux à l'excès, à qui rien n'échappe et qui à besoin de vous dire tout ce qu'il a vu, tout ce qu'il a trouvé dans une maison, dans une ferme, dans une auberge du Royaume Uni: il vous donnera toute espèce de détails sur le père, la mère, les enfants, l'aïeul, l'aïeule, le gendre, la bru, le valet, la servante, le chien, le chat, le bœuf, le mouton, le cheval et l'âne; il décrira les pots, les plats, les chaises, les tables, les étagères, et vous aurez devant vous le peintre Wilkie; mais, s'il omet une planche, un bâton, un verre, un clou de porte, cet homme là n'est pas Wilkie.

Il n'y a qu'un moyen d'exprimer sa pensée sur ce génie, si attentif et si fidèle au moindre détail de la nature, et ce moyen c'est d'essayer de peindre par la parole un des sujets qu'il a racontés lui-même par le pinceau.

Wilkie multiplie les contrastes et met én balance perpétuelle les airs de têtes, les attitudes, les gestes, les formes, les âges, les sexes et les tempêraments.

Il possède au suprême degré la vivacité du geste: on entend les éclats de rire dans le "Colin-Maillard;" je n'ai vu nulle part des enfants plus pétulants que dans la "Chasse aux rats:" C'est le génie d'Ostade jaillissant en étincelles. La "Lettre de présentation" est un tableau d'une expression profonde. L'intensité de la couleur est frappante dans "Les Joueurs de cartes." Le peintre excelle dans les ouvrages de petite dimension; il délaye ses facultés dans les grandes toiles. "Napoléon et Pie VII" est un ouvrage manqué. Les esquisses de Wilkie sont admirables; il les gâte souvent en les poussant plus loin par un excès d'application. Il reste un grand peintre: Il a la vie et il la donne.

Richard Bonington, qui véeut en France, et qui mourut dans la fleur de l'âge, est un des plus charmants artistes de l'Angleterre. Sa facilité était prodigieuse; son habilité se montra parfaite dès le jour où il prit le pinceau. Plus d'un artiste français m' a parlé de ce grand et doux jeune homme de quinze à seize ans, qui copiait les maîtres au Louvre et fesait chez lui des aquarelles magistrales, animées d'une verve qui contrastait avec son air tranquille.

Constable et Turner sont de véritables réformateurs, sortis l'un et l'autre de l'ornière des paysagistes anciens. L'école française abonde en artistes de talent, qui ont profité de leur exemple. Constable, surtout, a exercé sur eux la plus vive influence. L'apparition de ses tableaux à Paris (Exposition de 1824), fit dans notre école une véritable révolution. Géricault et Charlet, deux artistes dont la France s'honore, avaient vu à Londres les tableaux de John Constable, et ils les vantèrent partout avec cette générosité française toujours prête à glorifier, même à ses dépens, tout ce qu'elle rencontre de beau et de grand chez tous les peuples. La jeunesse prit feu aux ouvrages de Constable: nos paysagistes vivants les plus célèbres, Corot, Théodore Rousseau, Paul Huet, Troyon, Mademoiselle Rosa Bonheur sont ses admirateurs passionnés. Eugène Delacroix, de l'Institut de France,—qui fut l'ami de Thomas Lawrence, de Wilkie, de Bonington, de Copley Fielding, de Turner, d'Etty et de tant d'autres de vos artistes illustres, qui de leur côté ont admiré ses ouvrages,—M. Eugène Delacroix fut tellement frappé lui-même de la puissance, de la variété de la couleur de Constable qu' aussitôt après avoir vu ses tableaux il alla faire des retouches à son propre chef-d'œuvre de jeunesse "Le Massacre de Scio," une des toiles les plus pathétiques de ce siècle. Ce seul fait porte assez haut le génie de votre compatriote, et je me plais à l'ajouter ici aux précieux Mémoires de Constable, mis au jour par l'éminent Charles Leslie, de l'Académie Royale de Londres.

Il ne m'est pas possible de m'étendre dans ce discours sur l'œuvre de Turner, si profondément analysé par l'illustre écrivain John Ruskin, ni sur l'œuvre de John Constable. Mon admiration m'entraînerait trop loin.

L'aspect de la Création était pour Turner une magique féerie et pour Constable un orchestre divin. Le premier ennoblit, transfigure les sites, poursuit l'effet pittoresque avec les audaces, les hallucinations de l'inventeur; le second peint les lieux tels qu'ils sont, mais avec une profondeur d'observation, une énergie de sentiment, qui donnent à la plus humble de ses réalités le caractère de la plus haute poésie. Turner, sans oublier son indépendance personnelle, imite plus ou moins les maîtres de tous les temps et de tous les pays, et tire des contrées de l'Europe, quelquefois de son propre cerveau, des décorations éclatantes qui troublent ou enivrent les yeux; Constable prend tout en lui-même, et, concentrant ses affections dans les recoins chéris de sa terre natale, devient le paysagiste le plus vrai, le plus robuste, le plus expressif, le plus éminemment anglais. Inférieur peut-être par l'étendue des facultés à Gainsborough, qui, lui, avait aussi bien saisi la physionomie humaine que celle de la nature extérieure, Constable domine ce noble maître par l'énergie, l'éclat, la variété de l'exécution et par la rude virginité des émotions rustiques.

Hogarth, ennemi mortel de l'hypocrisie, poussa l'amour de la vérité jusqu'à la violence, Constable, en haine de l'affectation, s'attachait au naturel avec une sorte de fanatisme. Il gagne en fermeté, en certitude, ce qu'il perd d'ampleur et d'effet, lorsqu'il veut réprimer en lui-même les glorieuses audaces, les visions surnaturelles de Turner; mais sa fidélité à la simple nature n'a rien d'étroit ni de borné. Turner fait beaucoup pour la vérité; mais souvent il s'envole loin de la terre sur les aîles de l'imagination; si parfois il tombe, c'est de haut, et après avoir vu des mystères inconnus aux timides. Constable est un cœur naïf, un homme raisonnable; Turner est une âme altière et aventureuse, un rêveur exalté. Et pourquoi lui interdire ces élans, ces visions de l'âme, qui voit autrement loin que nos pauvres yeux de chair, obscurcis par nos pleurs? Contemplons la nature en poètes. Vue dans sa stricte réalité, elle n'est guère qu'une morne solitude ou un théâtre sans acteurs de génie; et l'artiste qui se contente de la rendre exactement et froidement n'est rien de plus qu'un copiste servile ou un vulgaire topographe. Mais le peintre doué de la passion de Gainsborough, de Turner, de Constable, prête à la nature physique une sorte de vie morale et de grandeur épique; il enveloppe le coin le plus dénué de la terre de toute la magie de ses pensées, fait parler aux flots, aux forêts, aux nuages, le langage de ses propres pensées, et dit avec Milton:—

> "Ce ne sont pas les lieux, c'est mon cœur que j'habite."

Mais, entraîné par la poésie générale de l'Univers, le génie de l'artiste tomberait dans le vide, s'il perdait de vue les plus petites choses que la Nature comprend elle-même dans son vaste sein. Elle a fait avec un égal amour, avec une égale perfection, la fourmi et l'éléphant, le brin d'herbe et le chêne, le caillou et la montagne. Comme la nature, le peintre peut se montrer grand dans les petites choses. La naïveté du sentiment, la fine précision de la main, font par moments toute sa force. Mais lorsque la Nature, cachant les détails de sa beauté, se pose dans l'ensemble mystérieux de son unité, l'humble émotion du cœur, la finesse de l'observation, la précision du pinceau ne suffisent pas à l'artiste. Ce qu'il lui faut, c'est l'exaltation du cerveau, la fougue et l'ampleur de la main. Ce n'est pas le fini à peindre, c'est l'infini à ébaucher.

Ce qu'il y a, Messieurs, de bien frappant pour moi dans le génie des artistes Anglais c'est la pénétration, l'énergie, la justesse qu'ils apportent dans l'étude de la nature et cette conviction spirituelle et naïve qu'ils savent aussi faire passer dans les ouvrages de pure imagination. A force d'être vrais, ils ne sont pas vulgaires. En poussant même cet amour inné de la vérité jusqu'à l'excessive expression des détails, ce qui, à première vue, semblerait contrarier la grandeur pittoresque, ils ont trouvé le moyen de rendre le côté vivant, intime, positif du caractère de leur pays, beaucoup mieux peut-être qu'ils ne le feraient en s'appliquant aux généralités de forme, de couleur et d'effet enseignés par les vieux maîtres du continent, pourtant si chers à Reynolds, à Gainsborough, et à Thomas Lawrence. Semblable au vin généreux, qui mûrit au soleil de la France, l'art Anglais, excité par la douce et forte chaleur du foyer domestique, a, lui aussi, le goût du terroir, l'odeur de la patrie. Il est Anglais, et non pas un insipide imitateur des autres peuples; il est bien Anglais, c'est à dire libre; Anglais par toutes les fibres du cœur, par toutes les excitations de l'intelligence, et l'Europe admire la vive originalité, la forte indépendance de vos maîtres. Ils ont ce vigoureux sentiment qui donne la vie, le mouvement, l'expression, aux plus humbles et aux plus nobles sujets. Leurs peintures sont les vivants miroirs de votre caractère, de vos mœurs, de votre civilisation. Ces vieillards, calmes et sévères, qui, les mains entrecroisées, le front clair, les yeux pensifs, semblent, sur ces toiles, récapituler les longues années d'une existence laborieuse et sage, ce sont vos pères vénérés; ces femmes fortes, tranquilles et douces, si attachées aux soins de l'intérieur, sans penser aux énervantes frivolités du monde, ce sont vos épouses fidèles; ces enfants robustes, joyeux et dociles, anges de la maison, jouant avec les animaux familiers, et poussant, au milieu des joujoux, les hourras de la Christmas, ce sont vos beaux enfants; et ces hommes mûrs, dominant le tableau, comme des patriarches aimés et obéis, c'est vous-mêmes. Voilà, Messieurs, les sujets favoris des artistes Anglais, de véritables poèmes intimes et touchants, inspirés par l'amour de la plus sainte des institutions: LA FAMILLE.

Et quelle variété de maîtres vous avez, Messieurs, la gloire de compter: ceux qui suivent leur propre fantaisie; ceux qui s'inspirent de vos poètes, si nombreux et si grands depuis Shakespeare jusqu'à Tennyson; ceux qui traduisent les éloquentes pages de vos historiens, depuis Hume jusqu'à Macaulay; ceux qui donnent une seconde vie aux admirables types de vos romanciers Swift, Sterne, Fielding, Richardson, Goldsmith, Walter Scott, Charles Dickens, et Thackeray.

Je les aime encore ces artistes qui nous montrent avec tant de verve et de franchise tous les traits du caractère de John Bull, son activité, ses passions, ses douleurs ou ses vices, sa grosse jovialité ou sa mordante ironie.

Je les aime, vos paysagistes, si attachés à la terre natale que les plus longs voyages semblent fortifier leurs impressions nationales au lieu de les affaiblir: Je me plais à les suivre chez vous dans les plaines fécondes de Nottingham et de Peterborough, aux magnifiques troupeaux groupés sous les grands chênes; sur la colline de Greenwich, d'où l'on voit l'immense panorama de la Tamise se dérouler à travers les changeantes magies d'un ciel violenté par la lutte du soleil, des brumes et des fumées de vos incessantes fournaises; sur les hauteurs de Hampstead, de Highgate, et de Richmond, où l'on jouit si vivement de l'air pur et du silence de la nature, quand on évite pour un moment le tumulte de Londres et l'oppression de son atmosphère. Je traverse avec ces artistes charmants les rivières, les bois, les champs si bien cultivés du Suffolk, les terrains tourmentés du Yorkshire, les sauvages gorges de l'Ecosse, les riantes collines de l'Irlande, les lacs du Cumberland, les falaises de Jersey, les plages de Liverpool, couvertes d'émigrants qui s'en vont, l'espérance ou la tristesse au cœur, chercher une nouvelle vie dans les contrées lointaines; et je regarde bien souvent d'un œil épouvanté les embarcations de vos incomparables peintres de marines, ballottées par les tempêtes, ou brisées contre les rochers de la côte.

Oui, les peintres anglais ont tiré de la Nature toutes les formes, tous les caractères, toutes les harmonies. En s'attachant à rendre avec une profonde sincérité l'aspect de la création, ils ont fait sentir d'une manière simple, pathétique, éclatante, ou grandiose, le lien moral qui rattache la pensée de l'homme, le rêve des bêtes, la sensation de plantes, la vie des éléments à la mystérieuse et solennelle puissance de Dieu.

Pardonnez moi, Messieurs, d'avoir passé dans ce discours, déjà trop long, sur beaucoup d'artistes qui, à divers degrés, honorent la tradition de votre école: Benjamin West, Fuseli, Northcote, Cosway, Opie, Morland, Romney, Copley, Harlow, Hoppner, Jackson, Raeburn, Stothard; sans compter encore les architectes, les sculpteurs, les peintres de miniatures, d'aquarelles, les dessinateurs, et les graveurs; tous les artistes, enfin, qui, du portrait à la toile héroïque, du mausolée au temple, du buste au groupe équestre, de la vignette au tableau, ont marqué ce qu'ils ont touché de l'empreinte particulière à leur génie.

Permettez moi, Messieurs, de ne point faire ici l'éloge personnel de vos artistes vivants, en leur présence. L'étude de leurs ouvrages, nécessaire à l'achèvement d'un livre que j'écris, (" Histoire des Artistes Anglais morts et vivants") est précisément ce qui me retient dans ce pays.

A l'exception des artistes de l'école française, dont le cœur et l'imagination ne veulent pas vieillir, les chefs des autres écoles du continent semblent s'user dans les stérilités de l'imitation. Vous, artistes anglais, sans mépriser les grandes traditions de la Grèce et de l'Italie, vous savez rester originaux et libres. Les écoles du continent sentent le poids de l'âge et les fatigues de la gloire. Elles comptent déjà cinq siècles d'existence; l'école anglaise est jeune, et à peu près contemporaine de la Société des Arts.

Depuis l'Exposition Universelle de Paris, depuis l'Exhibition de Manchester, elle a définitivement conquis les sympathies de l'Europe et reçu la visite des plus illustres personnages : vous avez vu, Messieurs, dans vos galeries, Sa Majesté l'Empereur des Français, S.A.I. le Prince Napoléon Bonaparte, S.E. M. Achille Fould, Ministre d'Etat. Nos écrivains célèbres les ont vantées: MM. Prosper Mérimée, du Sénat et de l'Académie française, dans la " Revue des Deux Mondes;" Charles Blanc, dans un livre intitulé " Les Trésors de l'Art;" Edmond About, dans son " Voyage à travers l'Exposition Universelle;" et Théophile Gautier, dans le " Moniteur Universel."

Les artistes, les écrivains français sont toujours bien reçus chez vous, Messieurs. La gracieuse libéralité des honorables et savants fonctionnaires qui dirigent vos Institutions et conservent vos richesses d'art, s'est étendue jusqu'à moi. Et je saisis avec bonheur l'occasion de rendre un hommage public à l'éminente bonté de Sir Charles Eastlake, Président de l'Académie Royale, qui tient ici, en ce moment même, le siège de la Présidence; à MM. Charles Landseer et Richard Redgrave, de l'Académie Royale; á MM. C. Wentworth Dilke, chairman du conseil de la Société des Arts, et Peter Graham, membre du conseil, chevalier de la Légion d'honneur; à M. John C. Deane, Commissaire Général de l'Exhibition de Manchester; à M. P. Le Neve Foster, secrétaire de la Société; à MM. Carpenter, conservateur du cabinet des Estampes au Musée britannique, et J. C. Robinson, conservateur au Musée de Kensington.

Encore un mot, Messieurs, et je finis. L'Art et l'Industrie en Angleterre resserrent de plus en plus le lien qui les unit. Pendant que vos industriels développent la puissance matérielle de la nation, vos écrivains, vos orateurs et vos artistes ennoblissent son génie. Vous avez, à la fois, l'invention positive, qui dompte la nature et l'aspiration idéale qui élève la vie. En devenant les protecteurs des artistes, les riches manufacturiers de Londres, de Manchester, de Birmingham, de Liverpool, tendent à augmenter l'élégance de leurs produits et à leur donner la supériorité, sur les marchés du monde; en s'entourant de chefs-d'œuvre, ils ont aussi trouvé la plus noble des distractions; en les réunissant dans des exhibitions publiques, ils éclairent et réjouissent l'âme assombrie des populations laborieuses.

Ainsi, Messieurs, vous faites tourner toutes choses au profit de la puissance et de la gloire de votre Patrie, sans vous énerver dans l'enthousiasme; vous fortifiez en vous-mêmes l'intelligence par la volonté; vous assurez l'action par la persévérance; vous ne perdez jamais l'avantage conquis. Dans l'énergie de l'Angleterre chacun de vous est une force individuelle, solidaire de toutes les forces du pays. Chacun de vous à son tour, selon l'expression de Shakespeare, est un de ces citoyens dans la taille duquel " chaque pouce est homme." Au sentiment de votre énergie vous alliez le respect de la loi; inaccessibles au découragement vous poussez toujours à bout vos entreprises; insensibles à l'échec, vous les recommencez. Voilà pourquoi le peuple Anglais, sorti d'un petit groupe d'îles perdues sous les brumes du Nord, a pu, en un siècle, fonder deux des plus vastes Etats du monde, et remplacer l'Amérique perdue par l'Empire de l'Inde.

DISCUSSION.

Mr. William Hawes regretted that he was not bold enough to convey to M. Silvestre the opinion which he was sure was entertained by all present, upon the paper they had heard, in the language best understood by that gentleman, for he wished him to feel how thoroughly they appreciated the eloquence, the clearness, the great talent, and the accuracy with which he had noticed and recorded the distinguished features of the works of the most celebrated English artists. Every one present would be delighted to find that a foreigner, coming to this country, to prosecute the objects which M. Silvestre had in view, had had the opportunity of studying so minutely not only the peculiarities of the works of each artist, but also the distinguishing characteristics of the English nation. No paper could have been more complimentary to English art than this had been, and if one thing marked more strongly than another the progress of the friendly feeling existing between this country and France, it was the fact that this was the first time that a paper had been read in the French language before this Society, and it was gratifying to find that those present were able to appreciate the very beautiful ideas that it contained. There was one matter-of-fact to which he might be permitted to allude. He thought M. Silvestre was in some degree mistaken in saying with regard to our great Flaxman, that the study of the marbles of Egina had imparted to that sculptor his most beautiful conceptions. He believed he was right in stating that Flaxman had produced some of his greatest works before he had the opportunity of studying those marbles.

Sir Thomas Phillips might be permitted, as a member of the Council, to express the strong impression that had been made upon his mind by the reading of the paper. They had not to be told in the present day that Art was of no one country, but the true admirer of Art estimated it without reference to the peculiarities of any particular nation or school. It was not to be expected that they should all agree with respect to the merits which M. Silvestre had attributed to individual artists—difference of opinion would always prevail upon those points—but none could doubt that M. Silvestre had done the most ample justice to English Art. Occasions of this kind, which brought together men of different countries, and made them acquainted with the kindly feeling with which each nation was animated towards the distinguished men of other nations, were calculated to extend the beneficent influences of art and industry, and tended more than anything else to knit together in more lasting ties of friendship the nations of the world.

Mr. John Bell thought, with reference to the exception taken by Mr. Hawes, relative to Flaxman's study of the Eginetan marbles, that probably the marbles of the Parthenon were meant. Certain it was that the mind of Flaxman was moulded before he saw those beautiful works. It was delightful to find that the efforts of this country in art had been appreciated abroad. Flaxman himself was an extraordinary instance of the ready appreciation of British art in other countries. He believed his beautiful compositions from the Iliad and Odyssey had gone through several editions more abroad than in England. In fact, great as Flaxman was, his own country was perhaps the slowest to appreciate his merits. He only wished, as far as he was concerned, that he was able to convey to M. Silvestre, in his own language, the obligations which he personally felt, as a sculptor, for his recognition of the works of our greatest masters.

Mr. Lavanchy had waited in the hope that some member of the Society would have expressed in the language of M. Silvestre their high sense of the interesting paper which had been brought before them that evening. How-

ever incompetent he might be to do so, he would take upon himself to convey to that gentleman the sentiments which he was sure pervaded the meeting after hearing this admirable paper. Mr. Lavanchy then addressed M. Silvestre in French, expressing his grateful thanks for the valuable paper he had just read, and for the kind manner in which he had spoken of our artists, which entitled him to our gratitude. He had alluded to the late John Constable, with whom he (Mr. Lavanchy) had had the pleasure of being acquainted, for it was by his late friend John Arrowsmith, brother-in-law of the lamented Daguerre, that his works were first exhibited in Paris, and they were forwarded through him (Mr. Lavanchy). His deep regret on that occasion was his want of competency to do justice to the great merit of Mons. Silvestre's paper, but as an Englishman he felt he could not remain silent without committing a breach of duty.

Mr. Digby Wyatt said there were two qualities eminently characteristic of Frenchmen which M. Silvestre had exemplified on that occasion, namely, politeness, which in France might be said to begin from the cradle, and eloquence, which was possessed by almost every Frenchman. It must, however, be remembered, that M. Silvestre, like a skilful musician, had spoken *fortissimo* upon those points which were most agreeable to our national vanity, and *pianissimo* when treading upon more tender ground. But it behoved them, as people desirous to give a practical turn to these discussions, to recollect that some of these criticisms were probably presented to a certain extent *couleur de rose*. To all that M. Silvestre had said there was nothing to object. All that he had said of Hogarth, Gainsborough, and other English painters, they must agree with; but he had not told them that there still existed in art realms which we had not conquered. It was impossible to examine those beautiful photographs of the works of Raphael now exhibiting on the walls of the room, and then to look at the works of Barry, without seeing that there was a sublime in art which had we not yet attained. It would of course be impossible to treat of this vast subject in one paper, but if they regarded the advance of arts and industry in this country, they must remember that it was not wise to indulge in too much admiration of the past, whether in our own or other schools, for that would be to discourage effort; nor on the other hand should they depreciate those productions, for that would tend to make them over-estimate their own; but what they should do was to accept with gratitude every step made in advance, and strive to go still further. With regard to the present day he thought they must admit that pictures were regarded too much in the light of upholstery and furniture. If we were really to advance the art of painting, it must be placed more in the same category with sculpture and architecture. The subjects would then be treated with a more becoming dignity, and we could then hope to rival the great men of past ages. Even in the most ordinary branch of the art—that of portrait-painting—there was an immense deal that was now neglected. How seldom did they see a picture of that character that included more than one individual. The moving historical events of the period were but seldom recorded upon canvas. Such pictures as the "Reform Banquet" were now very rare indeed. He must say that he thought the most hopeful element for English art consisted for the future in the close alliance of all its different branches—painting, sculpture, and architecture, thus truly forming one great whole. Mr. Wyatt concluded by addressing M. Silvestre in French, expressing his high gratification at the brilliant manner in which he had reviewed the English school.

Mr. James Fahey said there was one portion of the paper which struck him very forcibly—that was the effect which the pictures of our great painter, John Constable, made when they were exhibited in Paris. He was old enough to remember that circumstance, and he thought one of the most noble traits of M. Silvestre's paper was the honourable testimony he had borne to the influence which Constable's pictures had had upon the French school of landscape painting. He remembered it very well, for he was in the part of the country where Constable resided at the time. But there was another curious fact. M. Silvestre had passed a just eulogium, not only upon Constable, but also upon Gainsborough, and had made some remarks relating to the flat character of the scenery that they had painted. It was a curious circumstance that those two eminent painters had both lived in parts of the country where the scenery was devoid of beauty.

Mr. C. Wentworth Dilke said, as chairman of Council, the duty devolved upon him of proposing a vote of thanks to M. Silvestre for his paper. He was very much struck with several portions of it, more particularly the admirable criticism upon the works of Hogarth, whilst the description of Wilkie's pictures, as also those of Constable and Turner, was well worthy of the attention of this Society. It was not for him to detain the meeting by any lengthened remarks. The duty he had to perform was a most agreeable one, and that was, on behalf of the Society at large, and the Council in particular, to propose a cordial vote of thanks to M. Silvestre for this paper, on the preparation of which he must have bestowed a vast amount of care and attention.

The vote of thanks was passed by acclamation.

The Chairman then informed M. Silvestre, in the French language, of the very cordial manner in which the vote of thanks had been proposed and carried, and concluded by expressing on his own part the remarkable gratification which the reading of the paper had afforded him. Many of M. Silvestre's views in reference to Hogarth and other leaders of the English school, he might venture to say, were new even to English artists, and evinced a most careful and minute study of those masters.

In acknowledging the compliment, M. Silvestre said,—Messieurs, Je suis profondément ému par l'expression si généreuse de vos sympathies pour moi. Mais il me reste encore beaucoup à faire pour me trouver à la hauteur des éloges dont l'éminent Sir Charles Eastlake vient de m'honorer, en son propre nom, au nom de la Société des Arts et au nom de l'Académie Royale de Londres. Ma position devant vous était simple, Messieurs: je n'avais à dire que la vérité, et je l'ai dite librement à des hommes libres, sans me préoccuper de la moindre question d'amour-propre ou de préjugé national. J'honore de mon mieux le génie chez tous les peuples, sans rien perdre de l'ardent et profond amour que j'ai pour mon pays. La vérité, Messieurs, ne s'arrête pas aux limites de la géographie. Je dis toujours ce que je pense, et je pense ce que je dis. Je n'oublie pas surtout que je suis en Angleterre, le pays où l'on ne flatte pas. S'il est vrai, comme l'a fait remarquer tout à l'heure un honorable membre de cette assemblée, que John Flaxman ne se soit point inspiré des marbres d'Egine et des vases étrusques, je le remercie de m'en avertir. Il m'est toujours agréable de recevoir des conseils et même des rectifications. Il n'en demeure pas moins certain que, par ses tendances de simplicité, Flaxman rappelle vivement et les Eginètes et les Etrusques. S'il ne ressemble à ces artistes antiques que par le tempérament, mes opinions tourneraient alors au profit de son originalité.

The Secretary called attention to a series of photographs from the cartoons of Raffaelle, executed and exhibited by Mr. Thurston Thompson, of the Science and Art Department, South Kensington.

The Secretary stated that having, at the last moment, received a communication from Mr. Benjamin Fothergill, of his inability to read the paper which had been announced for next Wednesday evening, Mr. Peter Graham would bring before the meeting for discussion, the report of the Society's Committee on "A Small Parcels Post."*

SWINEY BEQUEST.

A meeting of the judges appointed by the will of the late Dr. Swiney, was held at the Society's House on Thursday last, the 20th inst. (being the anniversary of his death), at 4 o'clock p.m.

The Secretary having read the advertisement calling the meeting, it was resolved unanimously—

> "That the bequest of the late Dr. George Swiney, viz., a silver goblet, of the value of one hundred pounds sterling, containing gold coin to the same amount, to the author of the best published treatise on 'Jurisprudence,' be presented to Dr. Alfred Swaine Taylor, F.R.S., for his treatise on 'Medical Jurisprudence.'"

Proceedings of Institutions.

CARLISLE (CHURCH OF ENGLAND RELIGIOUS AND GENERAL LITERARY ASSOCIATION).—On Tuesday evening, Nov. 2nd, a general meeting of the members of this Institution was held in the Reading Room, at the Athenæum, for the purpose of hearing an address from the President of the Institution—the Worshipful and Rev. Chancellor Burton—upon "The Objects of the Society and the way in which its usefulness may be more generally developed." The President was supported by G. H. Head, Esq., the Rev. Canon Gipps, H. Rawson, Esq., Rev. G. R. Moncrieff, Her Majesty's Inspector of Schools; Mr. McInnes; Rev. Wm. Bell; Rev. T. G. Livingston; Mr. James Barnes; Rev. J. A. Wilson; Mr. Harris, Hon. Sec., &c., &c. In the course of his address, the President urged upon the members that while the establishment of the news-room was an advantageous part of the system of the Institution, the mere reading of periodical publications was not their main object. It might become a foolish waste of time, and an encourager of idleness; it might be the means of imbibing mere dogmatical opinion; it might lead to many fallacies, and induce but a stupid persistence in an ignorant view. Standing alone, it might be found a very unsafe source of intelligence, and a closer—not an expander of the mind. He did not say, then, that they should not read the newspapers, but that they should not let them be their sole or even their principal reading. He earnestly recommended the constant use of their library, and he hoped that in course of time their funds would be sufficient to enable them greatly to increase its extent. He would not recommend them to form a library of the ancient classics, of the higher mathematics, of antiquarian researches, or of philosophical disquisitions; but of history, of morals, of religion, of arts—so far as they were applicable to the uses of life, and of all such information as might be brought into immediate and undoubted profit; their purpose was practical; and whatever they set up should promise a practical effect. Besides the kinds of books he had mentioned as not to be recommended, he would press, as strongly as possible, the avoidance of mere works of fiction. Much instruction might be conveyed, he admitted, through works of fiction; and fiction had often manifested itself as a very successful method of opening and enlarging the understanding, but he need hardly tell them what caution was necessary in their application to it. The Press now teemed with mere fiction, whose professed and whose only end was to amuse, encouraging, and even creating a vitiated appetite. Those who resorted to reading but for amusement, resorted to it with a very unworthy view; they learnt either nothing, or what it would be better for them not to learn. With reference to the subject of lectures, he represented the importance of making them systematic and regular, and not of a desultory and rambling character. It must not be their object just to amuse or entertain, or simply to touch the feelings: they must be designed and calculated to make a lasting and profitable impression; they must be made to teach something worth knowing. The value of classes was urged upon their attention, and the President explained, at considerable length, the arrangements of the examinations of the Society of Arts; and pressed upon his audience the importance of availing themselves of them. At the conclusion of the address, a vote of thanks to the President was proposed by Mr. Head, and seconded by the Rev. Canon Gipps. The President acknowledged the compliment, and the meeting was afterwards addressed by Mr. James Barnes, the Rev. J. Tasker, the Rev. W. Bell, of the High School, and other gentlemen.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Prof. Huxley, "On Biology."
Entomological, 8.
British Architects, 8.
Medical, 8.
Geographical, 8½, at Burlington House. I. Mr. Charles Sevin, "A Journey in Mexico." II. "Reports from Captains Burton and Speke, of the East African Expedition, on their Discovery of Lake Ugyi." III. Mr. J. W. Tayler, "On Notes on the Aurora Borealis of Greenland."
TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. Continued Discussion upon Mr. Scott's Paper, "Description of a Breakwater at the Port of Blyth."
Medical and Chirurg., 8½.
Zoological, 9.
WED. ......London Inst., 3. Mr. T. Rymer Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Society of Arts, 8. Mr. Peter Graham, "On the Report of the Committee of the Society on a Small Parcels Post."
Microscopical, 8.
Archæological Assoc., 8½.
THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Philosophical Club, 5½.
London Inst., 7. Mr. G. MacDonald, "On the Poetry of the 16th Century."
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
FRI.........Royal Inst., 8½. Mr. W. R. Grove, "On the Electrical Discharge, and its stratified appearance in Rarified Media."
SAT. ......London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 14, 1859.]

Dated 11th October, 1858.

2258. J. Saxby, Brighton—Imp. in apparatus for working signals on railways.

Dated 30th November, 1858.

2721. J. Luis, 1B, Welbeck-street, Cavendish-square—A watch, simplified with anchor escapements and rack, forming a double lever, catching in the pinion of its balance wheel. (A com.)

Dated 16th December, 1858.

2884. Capt. J. H. Selwyn, R.N., Woodland Crag, Grasmere, Westmoreland—A novel apparatus for paying out or laying down submarine telegraph cables or wires, and for raising the same after they have been laid down.

Dated 18th December, 1858.

2900. J. Mac Kenzie, Saint Martin's-le-Grand—Imp. in those gas burners known as ventilating sun burners.
2902. J. Taylor, Birkenhead—Imp. in the construction of pumps or engines for lifting and discharging water.

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* See *Journal*, Vol. VI., page 527.

2904. E. Weber, Mulhouse, France—Imp. in dyeing or colouring textile fabrics and materials, and in the machinery or apparatus connected therewith.
2906. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for re-working the waste steam of steam engines. (A com.)

Dated 20*th December*, 1858.

2908. S. Hunter, Newcastle-upon-Tyne—Imp. in the construction of anchors.
2910. J. Ronald, Liverpool—An improved machine for the direct spinning of hemp, flax, and other like fibrous materials.

Dated 21*st December*, 1858.

2912. F. Winter, Hoxton—Imp. in the preparation and application of varnishes for waterproofing paper, linen, and textile fabrics, and coating the same with metallic foils.
2914. W. E. Daudo, Manchester—Imp. in apparatus for lowering boats from ships or vessels, and also for raising the same as required.
2918. N. Dawson, 76, High-street, Poplar—Imp. in order books.

Dated 22*nd December*, 1858.

2922. G. Sharp and W. Elder, Jarrow, Durham—Imp. in furnaces and steam boilers.
2926. E. T. Dunn, Hammersmith—Improved fabrics suitable for the covering of floors, walls, and other like purposes.
2928. M. Shuldham, Dursley, Gloucestershire—Imp. in ships and vessels, and in working parts of their gear and rigging.
2930. A. Prince, 4, Trafalgar-square, Charing-cross—Imp. in ornamenting and illuminating surfaces of glass.

Dated 23*rd December*, 1858.

2932. D. Lichtenstadt, Henry-cottages, Park-road, Peckham—Converting a certain vegetable substance into fibrous material for the manufacture of textile and other fabrics.
2934. T. Bird, Manchester—Imp. in spinning, and in the manufacture of cop bottoms or cop tubes.
2936. J. Whitelaw, Dunfermline, Fife, N.B.—Imp. in sewerage and drainage apparatus.
2938. J. Maudslay, Lambeth—Imp. in the construction of ordnance and projectiles to be used therewith.

Dated 24*th December*, 1858.

2942. J. W. Child, Halifax—Imp. in dyeing wool and other fibres.
2944. E. Fellows, Canterbury—An improved vent peg.
2946. J. Railton and S. Lang, Blackburn—Imp. in looms.
2948. A. Smith, Humbleton-hall, Yorkshire—Imp. in gigs, dog carts, and other vehicles.
2950. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the permanent way of railways. (A com.)
2952. W. B. Johnson, Manchester—Imp. in the employment of gas for generating steam, and in engines connected therewith.

Dated 27*th December*, 1858.

2955. T. Steven and T. Scott, Glasgow—Imp. in heating apparatus for culinary and warming purposes, and in part applicable to steam-boiler and other furnaces.
2956. J. Smethurst, Guide-bridge, Lancashire—Certain imp. in metallic pistons.
2958. W. A. Gilbee, 4, South-street, Finsbury—Imp. in treating fatty bodies, and in the apparatus employed therein. (A com.)
2959. J. Macpherson, Aberdeen—Imp. in solidifying the raspings and other waste of horns and hoofs, and in applying the process to the cementing of prepared horns, hoofs, and tortoiseshell.
2961. C. M. Marion, Paris—An improved box or case for containing and preserving sensitive photographic paper, called "Marion's box."
2963. H. Lowe, W. Trueman, and J. L. Pitts, Birmingham—A new or improved axle for carriages.
2964. R. Hornsby, junr., Grantham, Lincolnshire—Imp. in ploughing and tilling land by steam power, and in apparatus employed therein.

Dated 28*th December*, 1858.

2965. B. Browne, 52, King William-street, London-bridge—Certain imp. in the manufacture of boots and shoes, or other coverings for the feet, and in the mode or method of uniting the same, or parts thereof. (A com.)
2966. J. Sinclair, Dublin—Imp. in pistons.
2967. T. Warren, Glasgow—Imp. in the manufacture of glass bottles.
2969. J. Leck, Glasgow—Imp. in drying textile fabrics and materials.
2970. C. Fay, Manchester—Imp. in railway carriages and brakes.
2971. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of boots and shoes, or other coverings for the feet. (A com.)

Dated 29*th December*, 1858.

2972. W. Haworth and W. Baker, Todmorden, Yorkshire—Imp. in the top clearers of machines for spinning.
2973. T. Welton, 29, New Compton-street, Soho—Imp. in giving or obtaining publicity, and of advertising either by day or by night.
2974. E. W. Carter, and J. D. Abrams, Rochdale—Certain imp. in sewing machines.
2975. W. Taylor, Nursling, and W. D. Grimshaw, Southampton—Regulating the admission of natural atmospheric air and eduction of rarefied air or gases from outhouses or any other place or premises, and for supporting a required temperature.
2976. R. D. Kay, Accrington, Lancashire—An improved chemical means of applying or fixing on woven or felted fabrics certain colouring matters produced from tar.
2977. T. Pickford, 15, Mark-lane—Imp. in the preparation and manufacture of manure.
2978. H. Hutchinson, Paris—Imp. in the manufacture of india-rubber goods.
2979. S. Morand, Manchester—Imp. in apparatus for stretching fabrics.
2980. A. V. Newton, 66, Chancery-lane—Imp. in machinery for reaping and mowing. (A com.)
2981. T. W. Gowing, Camden-town—An improved roughing for the shoes of horses and other like animals.

Dated 30*th December*, 1858.

2982. H. N. Maynard, Crumlin, Monmouthshire—Imp. in anchors, and in the manufacture of anchors.
2983. F. Puls, Roxburgh-terrace, Haverstock-hill—The treatment of hydro-carbons.
2985. F. Johnson and J. H. G. Wells, 12, North-street, Westminster—Imp. in constructing breakwaters and other similar structures.
2986. J. F. C. Heyne, Antwerp—Imp. in railway chairs and rails, and in the mode of fixing the same.
2987. T. Bell, Plaistow, Essex—Imp. in purifying gas.
2988. R. A. Brooman, 166, Fleet-street—Imp. in stoppering or closing bottles, jars, and other like vessels. (A com.)
2989. R. A. Brooman, 166, Fleet-street—Imp. in washing and drying machinery and apparatuses. (A com.)
2990. R. A. Brooman, 166, Fleet-street—Imp. in revolving fire-arms. (A com.)
2991. R. A. Brooman, 166, Fleet-street—Imp. in machines for embroidering.
2992. R. A. Brooman, 166, Fleet-street—Imp. in machinery for splitting or dividing hides, skins, leather, and other like materials. (A com.)
2993. R. A. Brooman, 166, Fleet-street—An imp. in pipes for smoking. (A com)
2994. W. Burgess, Newgate-street—Imp. in apparatuses for converting reciprocating into rotary motion. (A com.)
2995. S. S. Bateson, 17, Bolton-street, Mayfair—Imp. in generating steam.
2996. J. Knowelden, Southwark, and R. D. Edwards, Upper Belgrave-place—Imp. in hydraulic engines and apparatus connected therewith.
2997. J. W. Duncan, Grove End-road, St. John's-wood—Imp. in or connected with appliances for transmitting or conducting signals or action by electricity or magnetism, and in the method of testing insulating materials, combinations, or structures, for conducting electricity, and in treating malconstructed or invalid electric telegraph cables, and in utilizing parts of certain cables, or the application otherwise of such structures, and in certain insulating compounds, and in the apparatus and machinery used in connection therewith.

Dated 31*st December*, 1858.

2998. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the permanent way of railways. (A com.)
3000. H. Robin, Nantes, France—Imp. in reaping machines.
3002. T. Z. L. Maurel, 44, Rue du Dragon, Paris—An apparatus protracting indefinitely the working of any mechanism set in motion by springs, more generally applicable to clock-making.
3006. L. A. Normandy, 67, Judd-street—A new system of shaft tugs. (A com.)

Invention with Complete Specification Filed.

[*From Gazette, Jan.* 14, 1858.]

78. T. H. Toms, Staining-lane—The employment of certain materials for the production of raised ornamental figures or devices upon textile fabrics.—10th January, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Jan.* 14, 1859.]

January 14*th.*

1580. W. Woodcock.
1584. J. Jones.
1605. C. de Bergue.
1612. T. Hart.
1613. J. Spence.
1615. W. Wildes.
1626. W. Tasker, jun.
1629. C. Lambert.
1654. C. Gammon.
1656. J. B. P. A. Thierry.
1762. J. H. Johnson.
1814. W. E. Newton.
2162. E. L. Benzon.
2190. T. Preston.
2214. J. Milnes.
2352. E. B. Horn.
2415. P. Wright.
2486. B. D. Webster and J. Horsfall.

[*From Gazette, Jan.* 18, 1859.]

January 18*th.*

1628. W. Herepath.
1630. S. Maw.
1636. R. Clarke.
1640. W. N. Nicholson.
1644. J. W. Wilson.
1646. T. Piatti.
1652. B. Blake.
1653. H. Green.
1657. A. B. Tripler.
1668. W. Merry.
1679. J. Taylor and J. Nimmo.
1685. J. Hope.
1752. H. Greaves.
1759. J. Steel.
2025. G. Larsonnier & A. Blanche.
2554. C. J., T., H., & C. Thomas.
2625. W. Marshall.
2628. J. Easton, senr., and C. E. Amos.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, January* 14, 1859.]

January 11*th.*

84. T. C. Clarkson.
92. H. Emanuel.
93. W. Owen.

[*From Gazette, January* 18, 1859.]

January 13*th.*

106. W. Owen.
115. V. Scully and B. J. Heywood.
120. J. Fowler, junr.

January 14*th.*

110. T. H. Bakewell.

January 15*th.*

114. W. Prangley.
122. H. R. Worthington.

Journal of the Society of Arts.

FRIDAY, JANUARY 28, 1859.

◆

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement :—

For Blackburn.

Mr. Miles Baron, Northgate, Blackburn.
Mr. John Bell, goods traffic manager, Blackburn.
Mr. James Booth, druggist, Blackburn.
Mr. Robert Davies, Harley-street.
Mr. Ellis Duckworth, builder, Blackburn.
Mr. John Garstang, schoolmaster, Blackburn.
Mr. R. Hutchinson.
Mr. J. H. Margerison, Harley-street.
Mr. L. Penneston, 10, John-street.
Mr. John Robinson, Little Peel.
Mr. J. B. Stones, Heaton-street.
Dr. J. Withrington, King-street.
Mr. W. T. Lund and Mr. Robt. C. Radcliffe, *Hon. Secs.*

For Sussex (Brighton).

Mr. George Airey, Steyning.
Rev. John Allen, Brighton.
Mr. John Andrews, Grand Parade, Brighton.
Mr. W. W. Attree, Queen's-park, Brighton.
Mr. John Banks, jun., Hastings.
Dr. C. J. Beard, Grand Parade, Brighton.
Mr. R. B. Bessant, Brighton.
Mr. A. Bigge, stipendiary magistrate, Brighton.
Mr. R. W. Blencowe, the Hooke, Lewes.
Mr. John Brigden, Brighton.
Mr. J. C. Burrows, Mayor of Brighton.
Rev. Dr. Cary, Brighton.
Mr. C. Carpenter, Brunswick-square, Brighton.
Mr. George Cobb, Brighton.
Mr. J. H. Cole, Hastings.
Mr. Alfred Cox, Clarence-square, Brighton.
Rev. Albert Creak, Lansdowne-place, Brighton.
Professor Creasy, London.
Rev. S. R. Drummond, Brighton.
Rev. Archdeacon Garbett, Clayton.
Rev. J. Griffith, Brighton College.
Mr. John Grix, Littlehampton.
Mr. W. H. Harper, Shoreham.
Rev. E. C. Hawkins, Brighton College.
Mr. James Howell, Guildford-road, Brighton.
Dr. Jardine, Brighton.
Rev. H. J. Johnstone, York-road, Brighton.
Dr. William King, Brighton.
Mr. W. George King, Brunswick-place, Brighton.
Mr. Marc Anthony Lower, Lewes.
Mr. Frederick Merrifield, Dorset-gardens, Brighton.
Rev. Dr. Morris, Brighton.
Rev. John Newton, Brighton College.
Mr. William Olding, Brunswick-road, Brighton.
Rev. Archdeacon Otter, Cowfold.
Mr. George de Paris, Atlingworth-street, Brighton.
Mr. Montague Penley, Gothic-cottages, Brighton.
Mr. John Peto, Buckingham-place, Brighton.
Mr. Montagu Lyon Phillips, Grafton-street, Brighton.
Mr. M. Ricardo, Brighton.
Mr. Prideaux S. Rickards, Lansdowne-place, Brighton.
Mr. James Rock, Hastings.
Mr. W. D. Savage, Edward-street, Brighton.
Mr. Wm. Sleight, Deaf and Dumb Institution, Brighton.
Mr. W. Forster Smithe, Lansdowne-place, Brighton.
Dr. H. S. Turrell, Montpellier-house, Brighton.
Mr. T. W. Wonfor, Clifton-cottage, Brighton.
Mr. Robert Wright, Lancing.
Mr. Barclay Phillips, Brighton, *Hon. Sec.*

For Leeds (Young Men's Christian Institute).

Rev. Clement Bailhache, Victoria-road, Headingley, Leeds.
Rev. J. Blomefield, M.A., Incumbent of St. George's, Leeds.
Dr. Duis, F.R.A., Upper Fountaine-street, Leeds.
Mr. John Hardcastle, Aire-street, Leeds.
Mr. William Osburn, F.R.S. Lit.
Mr. F. A. Payne, Woodsley-terrace, Leeds.
Rev. H. E. Phillips, B.A., Incumbent of Christ Church, Leeds.
Rev. Alfred Rooker, B.A., Curate of St. George's, Leeds.
Rev. J. R. Thomson, M.A., East-parade, Leeds.
Mr. John Wood, B.A., Clitheroe-house, East Keswick, near Wetherby.
Mr. Charles S. Spence, 25, Mill-hill, Leeds, *Hon. Sec.*

In a letter, just received, the Secretary says :—"The prospects of the Board as to Candidates are very satisfactory. We have nearly 200 pupils in our evening classes, and we think, from accounts given us by the various tutors, that about 50 will be competent to compete at the approaching Examination."

For Lymington.

Mr. Nicholas Adam, Vice-President of the Literary Institution.
Mr. Edward Hicks, President of the Literary Institution.
Mr. Richard Sharp, *Hon. Sec.*

For Portsmouth.

Mr. Richard Abethell, Royal Dockyard, Portsmouth.
Mr. W. Besant, M.A., Fellow of St. John's College, Cambridge, Union-street, Portsea.
Rev. Professor Main, M.A., F.R.A.S., Royal Dockyard, Portsmouth.
Mr. Andrew Murray, Royal Dockyard, Portsmouth.
Mr. Robert Rawson, Mile End, Portsea.

This Board has been appointed by a Central Council, constituted of representatives from the Portsmouth and Portsea Literary and Philosophical Society, the Athenæum and Mechanics' Institution, Portsea, and the Watt Institute, Landport, and will conduct the examination of candidates from any of these Institutions.

For Richmond (Surrey).

Rev. H. Dupuis, Richmond.
Dr. James Ellis, Petersham.
Mr. C. J. Williams, Richmond.

ENGLISH ART IN FRANCE.

The following letter has been addressed by M. Théophile Silvestre to the Secretary of the Society of Arts :—

London, 26th January, 1859.

Sir,—At the meeting of the Society of Arts of the 19th inst., I thought it my duty to draw attention to the lively interest taken in the progress of European art by H. E. the Minister of State and of His Majesty's Household, by whom I have the honour to be accredited.

Allow me, sir, to take this opportunity of adding here, that the artists of Great Britain may feel assured of the sympathy with which their talent is regarded by his Excellency, who is particularly desirous to afford them every opportunity of obtaining in France a true appreciation of their merits.

His Excellency the Minister of State and of the Household of His Majesty the Emperor of the French has authorised me to invite English artists, in his name, to send their works to the approaching Exhibition, which will be held at Paris in April next. It is hoped that this Exhibition will include some works of considerable merit by English artists, and should this be so, I am assured by his Excellency that he will be most anxious to bring them under the special attention of the Emperor, with the view of inducing his Majesty to make a selection from among them.

I am, &c,,

THÉOPHILE SILVESTRE.

P. Le Neve Foster, Esq.,
Secretary of the Society of Arts.

EIGHTH ORDINARY MEETING.

Wednesday, Jan. 26, 1859.

The Eighth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 26th inst., J. A. Nicholay, Esq., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Battley, Edwin
Bossy, Alfred Horsley
Clare, Charles Leigh
Nickisson, John Charles
Ross, Thomas, jun.

The following Institution has been taken into Union since the last announcement :—

Frome, Mechanics' Institution.

The Paper read was—

ON A SMALL PARCELS POST.

By Peter Graham.

It is necessary that I should explain the circumstances under which I have been induced to bring the subject of a small parcels post under the consideration of our meeting this evening. It had been arranged, and announced in the *Journal* for several weeks past, that Mr. Fothergill would read a paper on the relative value of coal and coke in locomotives, but, unfortunately, that gentleman has been compelled to postpone his engagement to some future meeting, intimation of which did not reach the Council in time to make arrangements for any other original paper for this evening. The Council therefore thought it would be a good opportunity to bring before you the report of the Committee appointed for considering the expediency of establishing a General Post for small parcels (which was published in the *Journal* of the 9th July last) and it was suggested that I, as a member of the Committee, should read the report, and thus introduce the subject to your notice for discussion.

Feeling that the subject is of great importance to the public generally, and more especially so to the commercial and trading community, and knowing that some difference of opinion exists among members of the Council with regard to the report itself, I did not hesitate to assent, in order that it might be fully and fairly discussed.

My first impression was that my task would be best accomplished by simply reading the report and letting it speak for itself, because by the facts and arguments it contains, the conclusions arrived at are abundantly supported, and Mr. Chadwick, by whom it was drawn up, has therein given another proof of the zeal and ability with which he devotes himself to the interests of the public, whether in office or in honourable retirement.

On looking again at the report, I found that, if read through, but little time would be left for discussion, and therefore I resolved to omit some portions and epitomise others, although its effect will doubtless be weakened by this mode of treatment.

It is perhaps not generally known that the establishment of a post for the delivering letters in and around London originated from the enterprise of a private individual (Mr. Wm. Dowckra), about the close of the Protectorate, and that being thought to interfere with the power granted by parliament to the Postmaster-General, there was a trial at the King's Bench, and a verdict was given against him, with damages.

Mr. Dowckra petitioned the House of Commons, and was rewarded with a pension of £500 per annum, and afterwards, in 1697, was made Comptroller of the Penny Post, from which office he was dismissed in 1700, in consequence of complaints against him.

One of those complaints was, "He forbids the taking in any bandboxes (except very small), and all parcels above a pound, which, when they were taken, did bring in considerable advantage to the office, they being now at great charge sent by porters in the city, and coaches and watermen into the country, which formerly went by penny-post messengers much cheaper and more satisfactorily. He stops, under specious pretences, most parcels that are taken in, which is great damage to tradesmen by losing their customers or spoiling their goods, and many times hazard the life of the patient when physick sent by a doctor or an apothecary."

By this it is clearly shown that at the end of the 17th century it was the business of the post-office in the London district to deliver not merely small parcels, but even bandboxes.

Without further preface, I will proceed with the report, but the course I have adopted will impose upon me the necessity of making a few observations as I go on, and you may rely upon it they shall be as few and as brief as possible, my object being more to elicit the opinions of others than to express my own.

The Committee appointed by the Council for considering the expediency of establishing a General Post for Small Parcels, made the following

Report.

"By the law, as it now stands, every letter is defined to be a parcel, and every parcel transmitted by the post is defined to be a letter. The Treasury is restrained from charging more for letters than the rates particularised in the Act, but is allowed an unlimited discretion as to the imposition of any lower rates which may appear to it to be required by the public convenience and the interests of the revenue. The whole principle of a parcel postage, and the rates at which it may be best conducted for the public advantage, are by the legislature thus beneficially committed to the executive government.

"At this time, when, by the repeal of the newspaper stamp, a deficiency has been occasioned in one branch of revenue, the Committee hope to show that, by the improvement of the parcel postage, much may be done eventually to make good that deficiency, whilst great service may be rendered to the public and to the postal establishment itself, and even to the chief mail carriers and railway undertakings.

"The conveyance of small parcels by the post is not new to it in principle—at all events to the metropolitan district. In 1748, the administration of the penny post was spoken of by De Foe as admirable for the quickness of the transmission of parcels as well as letters from four to eight times a day: 'Nor are you,' he says, 'tied up to a single piece of paper, as in the General Post-office, but any packet under a pound weight goes at the same price.' In several of the continental posts a small parcel post is connected with the letter post."

The next paragraph gives various examples to show that the existing facilities for sending parcels through the post-office are rendered nugatory by the present postal rate of 2d. per oz., or 2s. 8d. per lb., which is so high as to be prohibitory, except for articles of small bulk, light weight, and high value, and in cases where rapid transmission is extremely important.

"The necessary expense of the separate transmission of small articles to distant places by any existing private means also in a great majority of cases amounts to a prohibition. In those cases where no porterage is required in sending the article to the coach-office, or to the railway-station, or from the terminus or the country coach-office to its destination, the transmission of small articles may be easy, and the charges moderate; but when there are one, two, or three miles of porterage at one or both ends the expense frequently exceeds the value of the article which would be sent if the charge were moderate.

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"But the post has already an agency, established and paid for, which may be called a general porterage, for the delivery of letters, available for rendering separate porterage, to the inns or the stations, unnecessary over a large part of the country. The post cart which from Kensington and Bayswater collects the letter-bags to be conveyed to St. Martin's-le-Grand, may, without injurious addition to the weights, carry small articles, for each of which the sender must now, if the direction be provincial, get a porter to carry it to the inn or the station, often at an opposite side of the metropolis. The postman who goes out from the country town a mile or two, to a house or village with a handful of letters, might, without inconvenient addition to his labour, carry a bag of small parcels. It will be found, therefore, in such cases, that at a payment of 4d. for a parcel of a ℔. weight the post may do at a profit that which the innkeeper could not do by the payment of the messenger for the one parcel of a shilling or two shillings,—an expense of labour which it is not worth while in the majority of cases to incur, and which is not incurred.

"The instances given are of cases of transmission over one line of main carriage from which separate porterage at either end is requisite. But when it is required to send any parcel over cross countries, or very long distances, the changes of carriers and the variations of charges which it is very difficult to ascertain, augment the obstacles to transmission at every change. These obstacles may be illustrated by supposing that a naturalist engaged on the coast at one end of the kingdom wishes to transmit a specimen or a small parcel from the Land's End to John o'Groats or May, the transmission being for the greater part of the distance over large trunk lines of railway, and the private means of conveyance in the highest state of organisation attained, or at present deemed attainable by private means. If, from the great amount of the charge, or from any loss or injury occurring in the transmission, there were occasion to investigate the changes of conveyance, with much labour, and by the aid of directories, they might be found to be as follows:—A small parced, to be transmitted from the Land's End to May, near Thurso, must be conveyed, 1st, by one foot messenger from the Land's End to St. Buryan; 2, by another foot messenger from St. Buryan to Penzance; 3, from Penzance to Truro by mail cart; 4, from Truro to Plymouth by mail coach; 5, from Plymouth to Exeter by South Devon Railway; 6, from Exeter to Bristol by the Bristol and Exeter Railway; 7, from Bristol to Tamworth by the Midland Railway; 8, from Tamworth to Preston by the London and North Western Railway; 9, from Preston to Carlisle by the Lancaster and Carlisle Railway; 10, from Carlisle to Greenhill by the Caledonian Railway; 11, from Greenhill to Perth by the South Central Railway; 12, from Perth to Aberdeen by the Scottish North-Eastern Railway; 13, from Aberdeen to Keith by the Great North of Scotland Railway; 14, from Keith to Elgin by coach; 15, from Elgin to Inverness by the Inverness and Aberdeen Junction Railway; 16, from Inverness to the South side of the Meikle Terry, near Tuin, by mail; 17, from the South to the North side of Terry by a boat; 18, from Terry to Thurso by mail coach; 19, from Thurso to May by messenger."

This may be taken as a fair example of the existing mode and means of conveying small parcels from one part of the kingdom to another.

"The members of the Chambers of Commerce of such places as Manchester, Liverpool, Glasgow, Leeds, Bradford, or Birmingham, by drawing lines from their own centres to the remote places of demand, may estimate for themselves the obstacles created by the changes of carriers to the transmission of small parcels. Usually each separate carrier has a separate rate of charges. One of the larger railways has upwards of four hundred different prices, charged, not upon any common scale of weight as for a service, but upon estimates of the necessities of the senders and what, from the nature of the goods, they can be made to pay, as to a monopoly for transmission. The railways are not always very accommodating towards each other, in respect to the transmission of each others goods, any more than each others passengers. The difficulty in ascertaining any cause of injury or delay which may occur in the transmission of parcels, is as the number of separate carriers.

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"In respect to smaller parcels, there is little or no experience of the effects of the multiform charges upon any attempted transmissions to the longer distances, the general effect being that the charges for them are simply prohibitory. From thence they are only transmitted at very long intervals when a relation or friend is travelling to town or to the place of destination, and will charge himself with them as part of his baggage.

"The transmissions of the small parcels of the description in question, by private conveyance, are so few and exceptional that they may be set aside as of no account, and it may be assumed that the great bulk of them are lost to the railway companies;—those that are sent being lost for separate transmission by being comprehended in the passengers' luggage; and those which are not sent being lost by the operation of the necessarily high prohibitory charge;—any considerable traffic of the kind being, in fact, out of their reach or means of sufficiently moderate charges, by the unavoidable necessary expense of separate porterage in distributing them.

"It is submitted that to meet the cases of these smaller parcels, the public postage service should be further utilized, and that in doing so the public revenue may be improved, with gain rather than loss to the railways. The service needed could not be rendered by any separate establishment or by any other means, so cheaply as by the post, in the great class of cases indicated. The establishment charges of the postal agency being already more than paid for by the penny postage upon letters; if we could also have a second distinct and universal system of porterage for small articles, the establishment requisite for that separate system must be maintained by an additional payment; and why should the public be put to the additional expense and trouble of an irresponsible and uncertain private agency, when there is a public and responsible agency already established which is available for the purpose? In a great number of cases, as already stated, the unavoidable expense of the second agency must, under any circumstances, be prohibitory for all but parcels of a great weight or of a high value, or very special character to make it worth while to pay for them as for an extraordinary service. No doubt, by the measure proposed, some private conveyances may be slightly interfered with, as coachmen and private carriers were interfered with by the institution of the Post itself—as bankers were interfered with in having, here and there, one of the larger remittances which they might have been charged with sent by post, amidst the vast multitude of smaller remittances which they could never have sent at the present rates, and which would never have been sent at all but for the new and beneficent service by cheap money-orders.

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"To maintain the present prohibitory rates on small parcels, for the sake of any private carriers' interest, is to retain unavoidably high charges for the separate porterage, amounting to a prohibitory tax, at a vast expense of public inconvenience, for the small gain (if any) of a few private persons. Indeed, under such an extension of service as that proposed, the carriage on the trunk lines and the railway profit on such carriage would probably be much increased. Mr. Rowland Hill's enlightened principle of saving the public the trouble of inquiring for the right charge, and the trouble of adjustment, by one uniform rate of postage, is applicable to the conveyance of small articles, in respect to which, at present—the public is, in addition to the heavy expense, subjected to the trouble of inquiring, or searching directories, for the proper place of despatch, and also of looking out for, what is commonly not easily found,—the means and time of certain delivery.

"When the destination of any small parcel is in the country or cross roads, the delivery is grievously uncertain, as well as expensive. Those who have had experience of the privilege of franking from large public departments, will have had repeated evidence of the common necessities in respect to small parcels, in the attempts to abuse the privilege for the purpose of getting them conveyed with certainty. At the present time the postal establishment is subjected to a war of evasion, for the conveyance of small parcels as books, of which instances might be given.

"The charge for sending the larger parcels by the old mail-coaches was from 12s. to 14s. per cwt. per hundred miles. The average weight of a passenger is under 165 ℔s. Assuming the railway charge for carrying first-class passengers were a general charge for the carriage of parcels, it would be at the rate of 1½d. per ℔. per 100 miles.

"Some time ago the estimated distance of the transmission of letters in England was about seventy miles each, exclusive of those sent by the district posts. An average of 100 miles for each small parcel, *inclusive* of those transmitted by the district posts and delivered within the districts, would probably be a very wide one.

"It has been avowed on good authority that locomotive expenses on railways do not, on an average, exceed 9½d. per mile, and that "the cost of running a train may be assumed to be, in most cases, about 15d. per mile." But it is observed in a paper by Mr. Edward Page, Inspector General of Mails, that "these rates, while they no doubt include in some cases special elements of expense not covered by the average of 15d. per mile, are independent of the receipts obtained from passengers, parcels, and, in some cases, from goods,—earnings which, added to the Post-office allowance have, in many instances, rendered the mail train one of the most profitable trains on the line," instead of being, as is sometimes supposed, a sacrifice and a grievance. Indeed it appears on impartial examination, that although the speed of the transmission of letters has been augmented by railway, the cost of the conveyance appears to be augmented against the public, the present rates being, in some instances, at from 2s. to 4s. per mile, or at a profit of from 60 to 260 per cent. on the actual cost, that is to say, supposing the train carried nothing but the mail. The contrast will be seen in a Table, from the Postmaster-General's second Report."

Here follows a table from the Postmaster-General's second report, showing that the average charge for mails conveyed by railways in the United Kingdom is 10d. per mile, and by coaches, &c., 2¼d. per mile.

"It appears, by the last report of the Postmaster-General of the United States, that the average cost per mile there (where coal and fuel is much dearer than in England) paid for the postal use of the railway, is only 5⅙ being little more than half the payment in this country."

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"But, taking even the rates of charges by mail coach, and the highest rates of charge for railway conveyance at 1½d. per lb. per 100 miles—taking a single parcel, if to the 1½d. for the main carriage in bulk, with others, we add a farthing—or, if that be too little—a halfpenny for the collection of the parcel from the letter receiving-house; and a halfpenny to the letter-carrier for its delivery from the place of arrival to the place to which it is directed, we have 2½d. per lb. for the cost of the labour on the prime cost of the service required for the public. The exact sums would be matter of investigation. But, assuming the cost stated to be near the mark, the public might be served at the rate adopted, in respect to printed matter, of 1d. for every four ounces, or 4d. per lb. for the conveyance of small parcels, with remunerative charges to the postage-staff and the letter carrier, which extra payment to the officers of the post for extra work is considered to be just and necessary, and consistent with a good profit to the revenue.

"It is assumed that the business of conveyance should be left quite free and open, and that, for all the larger packages, where time and convenience served, the present conveyances would no doubt continue at the cheaper rate at which they now are carried on. There is at present much parcel delivery by companies and private carriers, at rates under 1d., and even of a halfpenny per lb. By the South Western Railway Company, parcels under 7 lbs. are carried upwards of 70 miles for 6d.; under 28lbs., 39 miles for 8d. If the public right to utilise their own establishments for their own purpose were admitted to be justly questionable, the proposed rate of charge will be a high protection-duty to the fair interests of all private carriers, for they may be confident that the public will not pay 4d. per lb. where there is the option of getting the service performed at a rate of 1d. or a ½d.; neither will the public use the high-priced public postage, unless under strong and exceptional circumstances—that is to say, under those circumstances where the present charges are now, as a general rule, prohibitory."

Much pains is taken at the Post-office, and considerable expense incurred by examination of book parcels to prevent the inclosure of any letter, invoice, or writing in such parcels, and thus save an occasional postage stamp to the revenue. This regulation seems to be an error founded upon the tradition of a dear post.

"The Post-office authorities may be sure that, if anything be required to be delivered half a mile away, their own delivery for a penny will be found to be the most certain, cheap, and speedy, and the interests of the revenue may be confidently left to the operations of the interests of classes, in the more certain and convenient public conveyance.

"It is submitted, therefore, that whilst a merely weight parcel as well as book-postage, with such limitations as now exist against sending combustibles or other matters, dangerous or inconvenient, such as are now excepted by the postal regulations—might be made a means of improving the revenue and the postage system, it would confer, in the aggregate, great public conveniences, and be of collateral social advantage similar to that of the new money orders, as well as to the uniform and cheap post itself.

"On the principle, then, that the General Post, having the largest established machinery for collection and distribution, and the establishment charges for that agency being already more than paid for, and indeed, the former revenue being now re-placed by the small letter-post, the postal agency may be requested to perform other services at a profit—at rates which can only be performed by separate establishments at a loss.

"Upon their own observation and practical experience, and reasoning upon general principles, the conclusions above stated were agreed upon, when it appeared that the principles in question had been developed very fully before the Committee of the House of Commons on the conveyance of Mails by Railways.

"On examining the evidence, and the report of that Committee, they appear to be so important and conclusive in favour of the views and principles hereinbefore set forth, for the conveyance of all small parcels, as to require that some portions of the evidence should be cited at length. The *italics* and the remarks in brackets are inserted."

Before reading the extract contained in the report from the evidence of Mr. Rowland Hill, given before a Parliamentary Committee, I may be permitted to contrast the present management of the Post-office with that which existed in 1782, when Palmer first brought forward his plan for conveying the mails by coaches from London to Bath in 16 or 18 hours. The obstructives of the Circumlocution office of that day offered all the opposition in their power, and brought forward the most absurd arguments against the introduction of his improved system. They succeeded, by raising all possible difficulties, in retarding improvement, but by his indomitable energy, and the support of an enlightened minister, Mr. Palmer was ultimately successful in bringing into operation a system that conferred great advantage upon the public, and led to a large increase of revenue.

Happily the genius generally ascribed to red tapeism no longer presides at the General Post-office, and the system may be described as the very opposite of that which obtained when Palmer first propounded his system of carrying the mails; and there is little doubt that all difficulties and obstacles that might occur to the practical working of a small parcels post would speedily vanish under the enlightened management of Mr. Rowland Hill.

"The Committee find that, in reference to book parcels, such services of the Post Office (as we assume should be rendered for the conveyance of all parcels whatsoever), are thus described in the evidence of Mr. Rowland Hill himself:—

"'*Q.* What is the advantage which you think the public have with regard to the conveyance of books by post, instead of by other means of conveyance?—The principal advantage, I think, is, that the present system gives to the public the benefit of a very complete organisation for the distribution of book parcels [and all other parcels]; the organisation of the Post-office is exceedingly complete as compared with that of the railway companies for the same purpose.

"'*Q.* In what particulars?—If a person residing in one part of the country should desire to send a book to another part, he would find very considerable difficulty in knowing how to proceed, if he were entirely dependent upon the railways. North of the Thames, I believe, there is a general organisation for the distribution of parcels, so that a parcel taken, for instance, to Euston-square, would be carried all the way, say, to Aberdeen, for one payment, the sum paid being divided among the several companies concerned, according to an arrangement existing among them; but I believe that that organisation does not extend to railways south of the Thames. It therefore follows that even the towns which are upon railways are not connected with one another for purposes of this kind; but the difficulty is even greater, if an attempt be made to send a book [a small parcel] otherwise than through the post from one village to another; for instance, suppose a person living at a village in the neighbourhood of Wells should desire to send a book [small parcel] to a friend living at some village in the neighbourhood of Inverness. The parcel would have to be carried first, by *a village carrier*, probably, to Wells; then by coach from Wells to the nearest railway station; then by railway to London; then by van through London to the Euston-square station; thence by railway to Aberdeen, from Aberdeen to Inverness by coach, and from Inverness to the village by the *village carrier* [and these carriers must now commonly be employed and their time paid for, for the carriage of the single parcel]. Seeing that the parcel would have to pass through so many hands, I have every reason to believe it would be quite impossible for the person sending it to ascertain beforehand what would be the total charge which he or his friend would be subject to; and in the event of the parcel being lost on the way, it would evidently be almost impossible for any effectual inquiry to be made as to who was in fault. On the other hand, if the book [or small parcel] be sent by the post, the person sending it has no trouble of inquiring as to the means of despatching it; he has merely to put it into the nearest post-office, pay upon it a moderate, fixed, and well-known rate of charge, and it reaches its destination without any further care on his part; and should it be lost or detained, he has no difficulty whatever in addressing his inquiry to the Post-office, with the view of ascertaining where the fault lies. I think the Committee will see that the Post-office organisation for the purpose of distributing book [or small] parcels is therefore incomparably superior to any organisation which exists among the railway companies.

"'*Q.* If a parcel is despatched from England to Ireland, does the same postage carry it the whole way?—Yes; the uniform rate carries the parcel from any part of the United Kingdom to any other part; it would carry it even from the Channel Islands to the Shetland Islands.'

"Some of the larger railway companies having put forward the practice of carrying small parcels by the post as a ground for demanding a considerable rate for the conveyance of mails for the public, or more than the common rates to private individuals, the following replies were made to them, in behalf of the public, by the Post-office authorities:—

"'In reply to your (*i.e.* the Companies') complaint that the Post-office has well-nigh monopolised the parcel traffic, to which in your opinion railway companies had every reason to look as a legitimate source of revenue, it is sufficient to say:—1st. That the statement is a great exaggeration, and that your calculations of such traffic are founded on very erroneous data. 2nd. That by far the larger number of the existing railways, your own inclusive, were commenced since the establishment of penny postage, the time at which the Post-office began to share in the traffic to which you refer. 3rd. That the railway companies have no exclusive right in the parcel traffic, and, indeed, should be the last to complain of that interference with existing modes of conveyance which they themselves (I am far from speaking in blame) have carried to an extent for which it would be difficult to find a precedent. And lastly, it might be shown that the distribution of small parcels by the Post-office with its undivided responsibility, and its wide organisation, uniting every town and every village one with another, and thus supplying facilities which the railways do not possess, so far from injuring the railway companies, yields them a beneficial traffic. Its advantage to the public at large can need no demonstration.'—'I may mention,' says Mr. Hill, 'that with a view to this examination, I have made some inquiries of the publishers who use the book post extensively, and the information that I have obtained from them is to this effect, viz., that the large majority of the books sent through the post would not, but for the convenience afforded by the Post-office, be sent at all; and that the minority are not abstracted as small parcels which would otherwise be conveyed by the railway companies, but are taken from the large booksellers' parcels, such as are usually sent from the London publishers to the country booksellers. Now, as there can be no doubt that the Post-office pays the companies at a higher rate for the conveyance of the mails than that which the booksellers pay for their parcels, it would follow that, even if the whole of the books sent through the post were abstracted from the booksellers' parcels, the railway companies would still be gainers; but inasmuch as we not only pay a higher rate, but send a large number of books which otherwise would not be sent at all, it is manifest that the companies gain in two ways.'

" This reasoning is completely sustained by further evidence, and is at all points applicable, as previously stated, to the proposed improvement of the conveyance of small parcels, and illustrative of the views of this Committee.

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" Mr. Hill further illustrates this subject:—

" ' *Q.* With respect to the conveyance and distribution of these small parcels, do you think that any organisation of railways, or otherwise, that could be established, could take the place of that organisation which already exists in the Post-office system, penetrating, as it does, to every quarter of the United Kingdom, and to every remote village and town?—One can hardly conceive the possibility of another organisation equally perfect. If the railway companies were to attempt it, they would incur enormous expenses; and it appears to me to be more to their interest to avail themselves of our organisation than to attempt to establish one to compete with it. I would mention, also, if you please, with reference to this question of parcels, that in several parts of the Continent the heavier packets are actually charged at a lower rate; that I know to be the case in France. The charge for a letter not weighing more than seven grammes and a half, which is about equivalent to a quarter of an ounce, will be, on the 1st of July this year (when their law changes), 20 centimes, or 2d.; but for heavier packets they charge at the rate of 80 centimes, or 8d., for 100 grammes, which is equivalent to about three ounces and a third. Their rates, therefore, for heavy packets are less than one-third of the rate for letters, and there is no limit to the weight that may be sent at those rates.

" ' *Q.* Do you recollect that Captain Huish, in his own case, gives rather a good illustration of the use of the Post-office, in collecting a great number of small parcels from very remote quarters of the kingdom to one spot?—He does.

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" ' *Q.* You consider the distribution of small parcels by the Post-office a convenience to the public?—An enormous convenience to the public.

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" ' *Q.* Upon what ground do you say you do not think these parcels, if not conveyed by the Post-office, would not be conveyed by railway?—I believe my statement was, that the greater part of them would not be conveyed by railway, for this reason: that the railway companies have not the means of collecting and delivering them, and also because a large number of those parcels, as has been shown in evidence, are charged at very low rates. The companies charge rates so very much higher, that the imposition of those rates would, in all probability, prevent the transmission of most of the parcels. If I recollect rightly, fully three-fourths of the parcels in question are under the weight of two ounces; that is to say, they are carried at rates varying from a penny up to fourpence, and many of these go enormous distances; so that any charge which a single railway company might make upon those parcels must either be exceedingly small, or it must be such that the accumulation of charges would altogether prevent their transmission.

" ' *Q.* Admitting, as you of course do, that there is a certain amount of competition between the Post-office and railway companies for the carriage of parcels, would you not say that that competition extended only to a small number of those so-called parcels that we have been told are sent out from the General Post-office?—I should say that, if a law were passed forbidding the Post-office any longer to carry the parcels in question, very few of those parcels would be sent by the railways, or by any other means.

" ' *Q.* You do not think people would send pill-boxes and other things of that sort to the other end of Scotland or Ireland?—Certainly not.

" ' *Q.* Not if they could not go by the Post-office?—No.

" ' *Q.* That is a startling proposition?—It is one that I am prepared to maintain, however startling it may be.

" ' *Q.* You limit your observation to single pill-boxes?—Certainly. I dare say Morrison would continue to send his pills all over the kingdom; but then they would not go in small quantities, but in large quantities, and the amount of benefit that the companies would obtain from them would be very trifling, and far less, I hold (and that is the important point), than they now get.

" ' *Q.* Then the difference, if I understand you, is this: that in the one case you do not doubt that so far as the aggregate weight of packages is concerned, the railways are undoubtedly affected by what the Post-office carries; but that the packages separated into small parcels, or what is called the small parcel trade, would not be materially affected if the Post-office did not carry them?—I am of that opinion.

" ' *Q.* The same aggregate weight would still be carried by railways, whether the Post-office carried it or the railways?—Perhaps so, but if the Post-office pays in respect of the parcels that we carry as high a rate as the public WOULD PAY FOR THE CONVEYANCE OF AN EQUAL WEIGHT MADE UP, NOT IN SMALL PARCELS, BUT IN LARGE PACKAGES, IT NECESSARILY FOLLOWS THAT THE COMPANIES ARE NOT INJURED IN THE SLIGHTEST DEGREE; ON THE CONTRARY, SO FAR AS OUR ORGANISATION TENDS TO INCREASE THE NUMBER OF ARTICLES DISTRIBUTED OVER THE KINGDOM (AND THAT IT DOES TEND TO INCREASE THEM NO ONE FOR A MOMENT CAN DOUBT), THE COMPANIES THEMSELVES ARE BENEFITED.

" ' *Q.* In point of fact, you, being in the Post-office, which represents a public service, compete with private individuals who have constructed the railways?—The private individuals, when they constructed the railways, had no monopoly of the parcel traffic given them; on the contrary, the honourable member is perfectly well aware that the early railways were established simply as roads. It was not contemplated in the early legislation upon the subject that railway companies should carry anything; they were simply and solely the owners of the roads; subsequently to that, the penny postage was established. Now, the Act establishing the penny postage dates as far back as August, 1839; since that time a large majority of the railways now open have been established; and therefore, if there is any robbery at all [some of the companies having presumed to use that term], it is a robbery by the railways of the parcels that ought to go by the Post-office; it is the Post-office, therefore, that is entitled to complain of the railway companies stepping in and robbing them. The truth is, however, that both parties are bound to serve the public in the best manner they can, and there is no robbery on either side; those will get the custom who perform the duty most effectually.

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" ' *Q.* You compete with them by carrying and paying for upon their line in one form, what might be carried and paid for in a different form?—Certainly; and I hold that, if it be a competition, it is one highly advantageous to the companies themselves. *I believe that the railway companies could not take a step more injurious to themselves than one which would deprive us, if it were in their power, of the right of collecting and delivering parcels, for I hold that that is what we do. We collect the parcels and we deliver them, and we pay the railway companies and others for their conveyance.*

" ' *Q.* That is parcels paying letter rates, and which now pass through the Post-office since the last arrangement?—Yes, since the abolition of the limitation as to weight.

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Captain M. Huish, of the London and North-Western Railway Company, was asked—

"'*Q.* The evidence given by Mr. Hill is, that the up-parcels do not form anything like one-half of those which go by the down mails?—We find, taking a series of years, that our up-parcels into London are about one-half of those which go out of London. I might give a very striking illustration of this subject which fell under my own personal observation. Last year I had a bazaar in my grounds near London, for a very popular object connected with Ireland; about £2,000 worth of work was sent to Mrs. Huish for this bazaar; it was very well attended, and a number of titled ladies were kind enough to assist in it. My connection with that bazaar first gave me an insight into the working of the Post-office, for although I will not say that a grand piano came by post, everything short of it for this bazaar came by post. Of these £2,000 worth of worked slippers, and all the endless things which ladies made for the bazaar, a great quantity came by post [it being perfectly free to the railways to have collected and delivered them at the same very high price]; it did not terminate there, for a very large amount of the work which came from Ireland through the post was composed of that beautiful work for which the Irish schools are so celebrated; by means of the bazaar it was brought to the acquaintance of a number of ladies in London, and the result has been that since that time Mrs. Huish has established a complete system of trade with those schools, and she gets over every day lace, and all sorts of things, by post, not any of which ever goes by the railway company.' [We may add, not one of which, probably, could be carried by the railway company without separate porterage, a charge which would be prohibitory.]

"'*Q.* With reference to the parcels which came from various parts of Ireland, and the schools which are dotted over the whole of the interior of Ireland, the west coast, and everywhere else, do you believe *it is possible*, by any combination of railways which exist at the present time, with steam-boats, that those parcels could have reached London with the same punctuality and ease that they did by the Post-office? They would not have reached London quite *so cheaply* [the charge by post being a high one], I am aware; but I should like to have tried if I could not have brought them quite as correctly.

"'*Q.* As you are perfectly aware, those schools are dotted all over Ireland, upon private estates and in villages, and are matters of social improvement taken up by private individuals in the different localities of Ireland; do you think it possible, without an enormous expense, which would be far more than tantamount to any gain, to organise any system by which those parcels could reach London from all those innumerable points, with any degree of punctuality?—I am quite prepared to admit that the public does derive a very considerable advantage from the fact of the postal arrangements being in one hand, instead of being divided between a number of railway corporations, who have to work into each other's hands; I do not intend to bring this instance forward as a real grievance, to prevent the Post-office pursuing the system, but only as an illustration of the sweeping way in which the Post-office competes with us for parcel traffic; I admit what Mr. Rowland Hill has said, that we have no monopoly of parcel traffic, and do not ask for a monopoly.'

"It is undoubtedly one of the greatest conveniences which the public have in consequence of the plan pursued by the Post-office, that the Post-office is a direct communication, not by railway only, but they use railways where railways are effective, and steamboats where steamboats are effective; and where neither of those plans suit their convenience, they are obliged to have recourse to other means to reach every village in the United Kingdom; so that there exists a direct means of communication almost as speedy as can be obtained under the circumstances of the case, with every part of the United Kingdom.

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"The case of the bazaar is one on which the Society of Arts might rely as parallel to its own experience in respect to the collection and transmission of objects of art for its own exhibitions. But it is highly illustrative of the sense in which the word "cheapness" is used by the railway companies; that when it is admitted by the witness in behalf of the company that they could not have carried the parcels 'quite so cheaply' as the post, the cheapness referred to was a rate of two shillings and eight pence per pound, or no less than £298 per ton.

"In a letter by Mr. E. J. Page, the Inspector-General of Mails, published in the Appendix to the second report of the Postmaster-General, a further illustration is given of the principle in question. He states, as bearing upon the comparison of the railway and postal facilities for the conveyance of book parcels (which we submit as equally applicable to all small parcels)—

"'As bearing strongly upon this comparison of facilities, I may mention the somewhat remarkable fact, that copies of the very report of the Committee of Consultation of the London and North-Western Railway, in which the Post-office is represented as unduly competing with railway companies for the carriage of books and parcels, were extensively circulated to that Company's shareholders through the medium of the book post, not merely to towns and villages at a distance from their railway, but even to Liverpool, to which the Companies' own trains might have carried them without any charge whatever. When it is recollected that there are about 10,500 post-offices scattered throughout the United Kingdom, that there is scarcely a village without a post-office, and scarcely even a hamlet without a regularly established official means of communication with a post-office, and that consequently persons even in the most secluded districts can communicate by post with all parts of the kingdom with tolerable certainty, and with very little trouble or expense, it will readily be seen that such facilities as these must lead to the transmission of books and documents [and small parcels of all kinds] which otherwise would never be sent.'

"He adds further:—

"'Now, even assuming for a moment that every book parcel which the Post-office carries is abstracted from parcels which would otherwise be conveyed by railway, it is obvious that the companies would not sustain any loss by such parcels becoming part of the mail, if the Post-office paid to the companies for its mails rates only as high as the booksellers pay them for their parcels, in which, for the most part, such books would be conveyed, if they were sent at all. But it is a matter of fact, that the general rates paid by the Post-office to railway companies are largely in excess of those paid by the booksellers for their parcels. It follows, therefore, that the companies, instead of being injured, would be benefited by any such abstraction, seeing that, besides receiving a higher rate of remuneration for the carriage of these book parcels, they are entirely relieved of the cost of collection and delivery, a cost which, as Mr. Stephenson shows, renders goods traffic less profitable to railway companies than passenger traffic.'

"Mr. G. A. Saunders, the manager of the Great Western Company, alleges that they could carry parcels as punctually as the post, but he admits exceptions which, when examined, establish the whole case for utilising the post.

"'*Q.* Do you think the railways could organise any plan by which parcels could be delivered as punctually and conveniently by them as they are now by the Post-office?—I think they can be delivered just as punctually and conveniently, *with the single exception* [*i.e.*, eight or ten thousand] *of the more remote places where we have not got delivering agents*; in which case the Post-office bags taken to particular places possess an advantage over us, and it is there principally that they obtain the parcel trade.'

Mr. Saunders goes on to state that for the delivery of parcels in the country they avail themselves of the mail carts, by which means the Post-office derives great advantage in getting the mail bags carried much cheaper between the stations and the surrounding country, because these mail carriers derive benefit from the distribution of the parcels sent by railway. The report proceeds:—

"If the number of receiving-houses or delivering-houses of the largest company in the metropolis, be compared with the number of the receiving-houses and the deliveries of the Post-office, the case would be decisive for the adoption of a general public agency. But it is the remote suburbs of the metropolis, and the larger towns, the remote villages, the remote farms, and the remote gentlemen's seats—which comprise the larger bulk of the population—which are not to be reached without a new and separate agency; and in respect to them, it is demonstrable that, if the railway companies or any private carriers were to establish a new and separate and universal porterage, and were to charge only the prime cost of the labour of that new porterage, and nothing for any new investment, that separate charge must, to be remunerative, be prohibitory of the convenience and the traffic now contemplated.

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"The effect upon common carriage of the change we propose, appears to be, in some respects, exemplified by the change occasioned by the abolition of the compulsory newspaper stamp.

"When the stamp was compulsory, and when it conferred the privilege of free transmission, the great bulk of the stamped papers were conveyed by post. Since the abolition of the compulsory stamp, the number of newspapers conveyed by the post has been reduced to one-third the previous amount; the cheaper modes of private carriage being now resorted to for the conveyance of the bulk; the smaller portion, still transmitted by post, being exceptional cases, where there are no regular news-vendors' cheaper deliveries, and where the postal delivery must be resorted to, from the alternative of the expense of separate porterage being prohibitory. The bulk of the parcel or goods transmission would remain with the railways or with private carriers, and the bulk of the carriage along the main lines would be augmented by the amount of small parcels which will hereafter be sent at the book parcel rates, composed of the exceptional cases where the expense of separate porterage is now prohibitory.

"The facts confirmatory of this view are thus stated by the Inspector General of Mails, Mr. Page, in the document already cited:—

"'It has been ascertained,' he says, 'with regard to the night mails from London, by which by far the largest proportion of books is conveyed, that the reduction in the number and total weight of newspapers conveyed by these mails, since the alteration in the Newspaper Stamp Act, is more than *six* times the total number and weight of *all the book parcels.* To show the extent to which weight has thus been abstracted from the mails, I may mention that the number of carriage loads of bags sent from the General Post-office to the Euston-square station on Friday nights, has, since the recent Newspaper Stamp Act took effect, been *five* less than previously, and that the average nightly reduction of weight of newspapers despatched from London is upwards of *two tons and a half.* At the same time it is beyond doubt, that the effect of the Act in question has been largely to increase the newspaper circulation of the kingdom, and consequently to add still further to the earnings of the railway companies.

"'In fact,' he says, 'the book post service [to which we add the small parcel service] is one so different in its character and objects from that to which the parcel arrangements of the railway companies are adapted, that it may fairly be assumed it would hardly exist at all but for the extensive facilities for its development which the Post-office possesses. The evidence given before the Select Committee on the Conveyance of Mails by Railways (1854), especially that of Mr. Charles Knight, the eminent publisher, is very decided on this point. He says (3,872), 'that the cases in which books are sent by post may be nearly all considered as exceptional cases to the ordinary commercial operations of publishing,' and again (3,870) and (3,892), 'that the book post may be looked upon as a mere auxiliary to the conveyance of parcels by other means,' and (3,860) 'that if the existing regulations were stopped, the public would not be able to derive the same advantages through any other channel.'

"The conclusion may be adopted for the general small parcel conveyance by post, from the experience, as above stated, of the book conveyance by post, that at the like rates it will be simply auxiliary to any conveyance of parcels by other means, which open competition may supply at low rates.

"In such instances as that of the bazaar, only the lightest description of articles could have been forwarded, and many important contributions must have been excluded which could not have borne the present rates of parcel carriage. The railway companies would not, for their own book distribution, think of subjecting themselves to the charge for separate porterage.

"There were on the Committee of the House of Commons the chairmen of two large companies, and considerable shareholders. Nevertheless, the following resolutions appear to have been passed unanimously,—the objection to the public right and principle of a parcel-post may be assumed to have been abandoned by the chief representatives of the companies.

"'From a personal inspection of the Post-office on the day alluded to by Mr. Hill,' say the Committee of the House of Commons, 'your Committee have reason to believe that a large proportion of these parcels were of a sort which would not be sent, but for the facilities afforded by the Post-office in their distribution.

"'It is, however, undoubtedly the case' [the contrary, it may be observed, was very clearly proved], 'that a considerable amount of parcels is thus abstracted from the usual means of conveyance, and that the Post-office is become, to that extent, a competitor with public carriers.

"'Your Committee by no means recommend that the present practice should be abandoned; *on the contrary, they believe that incalculable advantages are derived from it by the public, not only as regards convenience in the transmission of common parcels,* but more particularly in the diffusion of literature and knowledge in country districts, which could not be approached with equal facility by other means.'

"The decision of the Committee of the House of Commons, and more particularly the evidence given before that Committee in the course of the important investigation, will be found, on impartial examination, in complete concurrence with the conclusions first stated in this report. The committee's decision establishes, upon the postal experience and testimony, the principle of a general small parcel post for the benefit of the public, and indeed for the real interests of the railway shareholders themselves.

"What some persons call leaving the business of conveyance to the 'free course of trade,' is, in fact, leaving the public conveniencies and necessities to multiform irresponsible monopolies. To dispense with the services of a public and nearly universal porterage—to forbid them to be exercised in free competition, even at high charges on the working expenses, is to maintain a protectionism of the worst sort.

"The returns show, that whilst 13 per cent. only of the weight of the mails carried is made up of letters, and

2 per cent. of book parcels, no less than 75 per cent. of the weight formerly conveyed consisted of newspapers.

"From the calculations of the deficit of revenue, but, above all, from the cheaper rate at which it will be practicable to convey large parcels, in which the newspapers may be conveyed along the main lines at less than fourpence per lb., the reduced rate at which printed matter is carried, it appears to be highly probable that a void will have been occasioned in the public mail bags, for some time at least, by the proposed alterations of the law in respect to newspaper stamps. This void the improvement and extension of the small parcel postage would no doubt eventually fill up. We say eventually, because we believe that the increased effects of the improvement, important as they are, will be gradual.

"In fixing the rate of postage for printed matter at fourpence per lb., it is to be presumed, and it is indeed clear, that the interests of the revenue have been fairly consulted. If no such rate had already been officially fixed, we should have proposed that, the charges for the establishment being already more than paid for, the amount of the extra service in collection and distribution, as well as in main carriage required to be performed, should be carefully and impartially analysed, and its prime cost determined, and a fair profit allowed to the post and to the postal establishment, and also extra remuneration to the collectors and distributors.

"By the opponents to the public parcel postage, it was alleged that it must impede the transit of letters. This allegation was decidedly negatived by Mr. Rowland Hill, who showed that a very trivial effect would be produced on the transit of letters if the parcel postage were taken away; therefore, very little effect upon the dispatch of letters can be fairly anticipated from the gradual additions consequent on the proposed improvement of the parcel postage. The Committee apprehend that, with the additional emolument derivable from an improved and cheapened parcel postage, deliveries by the use of carriages or horses may be eventually extended, and the general transit be improved to an extent proportioned to the extension of business. as with all great private establishments.

"The proposed parcel postage may be made the means of improving and completing the postal deliveries in rural and thinly-populated districts, where the deliveries are now very imperfect.

"In France, the postal delivery is established direct to every house. In England, the delivery to every house is not complete, although, under the existing administration, it is rapidly tending to completion. It is to be hoped that the measure proposed may aid the more complete accomplishment of that important object.

"The Committee of the Society, with their Chairman, Lord Ebrington, have availed themselves of a permission to see the central establishment at St. Martin's-le-Grand in operation.

"One night's inspection of the ordinary business sufficed to convince the Committee that the present edifice is inadequate to the accommodation of the present postal service of the country. That edifice was designed for the old system of postage, in which artificial light was required, to examine letters, for their taxation for enclosures chargeable for double postage; it is dark, and heated to excess with the gas-lights required for the transaction of the present business; it is badly ventilated, and overcrowded, and must be injurious to the health of those who work in it, and who deserve every fair personal accommodation they can receive in the performance of their duty to the public. Since it was constructed, the business has increased more than six-fold beyond the amount for which it was designed. It is understood that measures are being taken to remedy, as far as may be practicable, the want of ventilation, but the present building cannot be expected to be made suitable to the transaction, with proper comfort to the officers, of a five-fold mass of business.

"If the postage business of the country were conducted, at the existing or the proposed rates of charges, as a commercial business, by a commercial firm, there would be no hesitation in immediately acting upon a determination to obtain new and more appropriate premises. The profits arising from the extension of the business, at the proposed rates, would be looked to as a means of obtaining more extended structural arrangements, and for putting the agency on a better footing, and systematising completely the whole service.

"The Committee confidently urge the adoption of the proposed measure, as one which will conduce to the improvement of the whole of our present postal system, and of the condition of the subordinate agents, and means of general distribution.

"Whilst the Committee feel an entire confidence in the main principle of the measure they recommend—corroborated as it is by the powerful evidence recited—they would, as to the executive details, defer most respectfully and confidently to the ability and zeal prevailing in the postal department, by which one of the most important and brilliant administrative reforms of our time has been accomplished, not only for this country, but, by the influence of its example, for the civilised world.

"The chief conclusions arrived at upon an examination of the subject are—

"First, that the unavoidable labour, and consequent expense and uncertainty of the transmission of very small parcels, particularly over cross-country or through different lines of conveyance, whether by private means or by the public, is at present, in a large proportion of cases, prohibitory.

"That the postal establishment, having an agency for the collection and distribution of letters, (or what may be termed an universal porterage, available for the collection and delivery of small parcels), may, without any materially increased establishment charges, and with compensation to the establishment and profit to the revenue, render to the public the increased service of the conveyance of small parcels, at an expense not exceeding that of the book postage, or at a cheaper rate, as respects such small parcels, than could possibly be accomplished by any separate agency for the purpose.

"That it may render this service, as has been already done as respects the conveyance of books, without any serious detriment to legitimate private conveyance or railway service—but with increased profit to such private service by increased conveyance in bulk—arising from the increased transmission of small parcels, consequent on the increased convenience for their collection and distribution.

"That the proposed extension of the postal service to the transmission of small parcels will be of great convenience and benefit to the arts, to practical science, to industrial occupations, and to family and trading intercommunication.

"The Committee, therefore, propose to submit to Her Majesty's Government, that it will, for the special interest of the arts, and of trade, as well as for the general convenience of the public, as also in the interests of the revenue itself, and with extra pay for extra work to the public servants performing it—exercise the authority with which it is charged, to remove the limitation of the proposed rates of fourpence per lb. to printed matter, and extend the conveniences of the postal delivery to all other matters, subject to the like limitations for postal convenience to which the book parcel postage is now subjected."

DISCUSSION.

Mr. Alderman **Mechi** thought the proposition was so self-evident that there was very little to be added in the way of comment upon the facts that had been laid before them. With regard to himself, he lived in a retired district of the country—an illustration of thousands of instances—where the postman came from 4½ to 6 miles from the post-town; whether there was one letter a day or 50, his duty was to come, and if his pony or donkey cart were loaded with a few more parcels it would add to his income. There could be no doubt that the railway companies could not compete with the village letter-carrier in that instance. They might multiply that by thousands of instances all over the country. Then, again, it was to be remarked that the transmission of parcels by post would be exceptional. It was a question not so much of money as of time, when parcels were sent by post, for bulky parcels could be conveyed cheaply enough where time was not an object. He could have a ton of manure conveyed by the railway for 7s., to within 4½ miles of his premises, and he could get a bulky parcel at an equally cheap rate by the goods train; but when he had a parcel by post, if he paid for it at the rate of 4d. per pound, it was to ensure rapid delivery. He could enlarge upon this subject, but the advantages of the proposition were so obvious that he thought it quite unnecessary to do so. As a man of business, and referring to his own transactions and those of thousands of tradesmen in London, they must see that to prevent such a proceeding was to prevent a large amount of business that could otherwise be transacted between people at distant parts of the country. A single article might be sent over a large extent of country with security and cheapness of transmission whereas if such facilities did not exist, the transaction, would never take place at all. His own opinion was that the establishment of the system advocated by the Committee would prove highly beneficial to all classes of the community.

Mr. **Frederick Lawrence** thought the committee had only looked upon the favourable side of the question, and had totally disregarded the difficulties which he considered stood in the way of establishing a parcels post. The first circumstance which struck him was that a heavy letter or even a number of letters might be made into a parcel, and would then only be charged 4d.; this would be a serious loss to the Post-office; and he thought if it were the duty of the Post-office carriers to carry goods as well as letters, the increased weight they would have would very materially interfere with the speed of delivery. It was stated in the paper that a parcel sent from the Land's-end to Scotland would have to pass over a number of railways belonging to different companies. Surely this was no argument for a parcels post. The same process must be gone through with a parcel as with a letter; they could not send it over a different route because they sent it by post. It must, in either case, pass over the many different lines of railway enumerated, and he could not see what point was gained by mentioning different companies amongst which the lines of railway were divided. In going to Manchester, they might as well say, because they went over the lines of two different companies, there was a difficulty in getting there. There were various difficulties which suggested themselves to him, which however might, perhaps, be overcome. But, at the same time, he thought the committee, in going into this question, ought to have given some attention to these points, and to have stated how they proposed to get over these difficulties. He presumed parcels of the weight suggested would include band-boxes and articles of the like description; and one could picture to oneself the figure that the country letter-carrier would present enveloped in a load of bandboxes and other parcels. He submitted that if we were to have a parcels post it must be conducted as a separate affair from the present business of the Post-office, and would be better carried on by private enterprise. The Post-office had quite enough business at present, without being burdened with more, for he considered the effect of a parcels post would be to double the work of the Post-office. The book post was a very different thing. Books very seldom exceeded a certain size; but parcels of a pound weight would be of indefinite sizes and shapes. Were they going to restrict the size of the parcels to a certain limit? or did they propose to admit every parcel not exceeding a pound in weight whatever might be its size? He thought the operation of the book post did not afford a fair criterion that a parcels post would be attended with equal success.

Mr. **Salomons** had had considerable experience in the transmission of parcels by post, the number transmitted from his establishment last year being upwards of 1,500. He thought the present mode of transmitting parcels by post was sufficiently appreciated by the country, and any increase in the extent of the parcels would require another building equally as large as the present Post-office. If there was no restriction as to size, they would have crinolines and birdcages sent by post, and a letter carrier would present a figure anything but like that which was associated with their present ideas of a postman. Any extension of the present system would tend to make the Post-office the public carriers of the nation. He thought the Committee, if they were desirous of bringing this subject before the public, should have gone into the difficulties as well as the advantages of the system. They had had all the advantages pointed out, but no mention was made of the difficulties. If they took the small parcels away from the railways, the measure was certain to be followed by increased charges for such parcels as the Post-office could not carry, and in that way the companies would make up the loss which this system would entail upon them. Therefore he submitted that, looking to the interests of trade in general, they must give the railway companies the carriage of the small parcels as well as of the large, otherwise the rates would be increased for such parcels as they did carry. He believed that no post-office establishment could carry the quantity of small parcels of goods that would be sent into the country. With regard to the non-liability of the different railway companies over whose lines a parcel passed in course of transmission, for loss or damage, he begged to say that upon that point the Committee were in error. The person who took the parcel in was responsible. If a person sent a parcel from Wales into Scotland, the Welsh railway company, by whom the parcel was received, was responsible for its delivery in Scotland. No doubt the cost in such a case would be heavy, but they must not look to those rare cases in dealing with a question affecting the public good.

Mr. **Lawrence** wished to ask whether the committee had made any inquiry as to the working of the system known in London as Crouch's Parcels Delivery, by means of which small parcels could be transmitted to long distances at a charge of 6d. or 1s.

Mr. **Salomons** said upon that point he could state that Crouch's Delivery had agents in all the large towns. It therefore became, as Mr. Alderman Mechi had said, a question of time and not of expense; and where time was a consideration it must be paid for. Persons collected parcels in London, and distributed them in the towns at much less cost than the railway companies would carry them as single parcels. Baskets containing 40 or 50 parcels were carried at a certain rate per cwt., and distributed at 6d. or 1s. per parcel in the towns to which they were consigned, but the process was a slow one.

Mr. Alderman **Mechi** said that plan afforded no accommodation to the villages, of which there were a very large number, and he thought they deserved some consideration in the discussion of this question.

Mr. **William Hawes** said the question had been argued as one of time and expense, but there were other and more important elements to which their attention ought to be directed. He had come into the room believing that he should, perhaps, be the only person who took an exception to the report. He had carefully examined it to see, in the first place, what it recommended; in the next place, what statements it made; then, how the statements were illustrated; and, lastly, what were the conclusions arrived at. The first recommendation was a startling one, being no less than this—that the Government should be the universal carriers of the country for all letters, parcels, and merchandise, which would bear a charge of 4d. per lb., or £1 17s. 4d. per cwt. for collection, transit, and delivery. The whole argument was this, that there was at present no mode of conveying small parcels, except at rates which were almost prohibitory. The object of the argument employed was to show that the Government could collect, carry, and deliver, the parcels at a rate which would be unremunerative to railway companies—namely, 4d. per lb.; therefore, if the Government were to do that, which it was alleged private individuals or companies could not do, this amounted to a recommendation that the Government should be the sole carriers of all the parcels of the country which would bear a charge of 4d. per lb. The objections to such a system were manifest and strong. He objected to the Government becoming competitors in the trade of the country. He believed the principle on which the commercial prosperity of the country was based was the application of the industry and enterprise of private individuals in matters of trade, and to suppose that Government could successfully compete with individual and private enterprise was to shut their eyes to all past experience. No doubt the Post-office, as now established, had an advantage over all rival competitors; but they were told that the existing building was not of sufficient capacity for the work at present done there, yet it was proposed to add to this business an enormous bulk and number of parcels, so that if the service was to be really useful, they must have an extra building, an extra number of men, and extra conveyances in town and country capable of carrying on this new branch of business that was to be created, with the same regularity and dispatch as the present delivery of letters. This building must be erected by Government—in other words by the public, and with the money of the people, and with this it was proposed to enter into an unfair competition with the industry and private enterprise of the country. That, he was sure, would never be tolerated. The tendency of all this was towards the principle which his hon. friend behind him (Mr. Chadwick) was so prone to encourage, viz., the principle of centralisation, which, if successful in this instance, would very materially injure the mercantile interests of the country. They were told that the parcels service was at the present time the monopoly of the railway companies. If there were any monopoly at all, it was divided into a number of small monopolies, which it was proposed to concentrate in one huge monopoly. At present there could be no real monopoly, for almost all the principal railways were exposed to the rivalry of competing lines. They found the Great Western in competition with the South Western, and the London and North Western with the Great Northern, each having lines almost parallel running into the same district. The best proof that there was no monopoly, was afforded by the fact that the fares had been reduced so low as to nearly ruin the companies, whilst the public got the benefit; and if we placed the Government in a position to command a monopoly, we should do very serious damage to the public spirit and public enterprise of the country. Let them look at the question in another point of view. Was this a matter in which, under any circumstances, the Government ought to be placed in competition with private interests? They were told that the Post-office was an establishment peculiar in itself. The carriage of letters had been in the hands of the Government from the time when the postal system began in this country. The reasons which then existed for such a system did not exist now. The reason for Government interference with the transmission of letters originally was the want of safety in travelling along the main roads of the country, and the prestige of Government was then such that people would place property in its hands rather than in those of private individuals. But those reasons did not apply in the present day. If they admitted the interference of Government in such a matter as this, he would ask where was it to stop? Surely there would be more cogent reasons for the Government undertaking the business of the Bank of England. If they wanted to give the Government employment, let them place it where great interests were at stake, and in situations where important social and moral influences were involved. He altogether denied the propriety of admitting this principle, for he contended that private enterprise would do what was to be done, better and cheaper. As soon as a necessity for a parcels post was proved to exist, private enterprise would take it up and succeed. Look at the packet service as an illustration. That was originally entirely in the hands of the Government. But private enterprise set up those great companies the Peninsular and Oriental and the Royal Mail, and they had undertaken the carriage of the mails and parcels, and Government monopoly could not stand in competition with those private companies. The same argument applied to the parcels post. They were told that this new duty would tend to improve the postal service itself. There was the assertion, but the evidence was all on the other side. They were also told that the revenue would gain. One argument against this was that no letter postage could ever exceed 4d., as the heavy letters would, of course, be considered as parcels. He thought this would involve a loss. Moreover, what had the revenue gained by the book post? £16,000 a year! Would that pay? Undoubtedly the conveyance of books was to be justified on very distinct and superior grounds from a parcels post. The specific gravity of a book, its comparative weight and size, were almost invariably the same, but with parcels it was not so. They might have a parcel of only a pound weight and yet of several feet in dimensions. Was that to be paid for at the same rate as a book? Then, again, they were told that if the postal business were conducted upon true commercial principles, new premises would be provided in lieu of the old ones, which were found to be insufficient and ill-adapted for their present purpose. This was a proof that Government work was not done well unless private enterprise came into competition with it, and it was only private enterprise that kept it nearly up to the mark. Let them look for a moment at the illustrations given in favour of this project. The report, as read, conveyed, though unintentionally, a misrepresentation. The evidence given in the report was printed with interpolations, between brackets, which did not form part of it, but this did not appear in the reading. He thought that putting in the word "parcel" in every case where "book" was used materially altered the evidence of Mr. Rowland Hill. It was quite true that the village postman might be able to carry more than he did at present, but how could they get their letters in London if the postman had to carry about bandboxes and parcels of all sorts and sizes! Then, as to another point, they were told that there had been a great decrease of newspapers passing through the post-office since the repeal of the stamp duty. This was in itself an argument against a parcels post, inasmuch as it showed that newspapers in bulk were now carried and delivered cheaper than formerly at one penny each. The Committee appeared to have overlooked the change that had recently taken place in newspaper literature by the introduction of the penny daily papers, and the increase which had taken place in the number of local newspapers since the repeal of the stamp duty. The report entered into some curious calculations as to the expense of running railway trains. He contended that they could not properly analyse the cost of a train which carried passengers as well as parcels, so as to tell whether a parcel carried at 4d. would produce a profit or otherwise to the company. The question of profit, however, was a small part of the matter. His great objection was to the policy of admitting Government to be competitors with private traders. But there was one special error into which the Committee had fallen. They called attention to the cheapness of conveyance upon the foreign lines of railway as compared with this country, and spoke of France doing so much. They alleged that cheaper accommodation was given there than in England, although it was stated that the cost of the French lines of railway was greater than in this country. Here again was an assumption, whilst the evidence was entirely the other way: for they would find by the address of the President of the Institution of Civil Engineers, that the expenses of railways in France were from 20 to 30 per cent. less than in England. His conclusions, upon a review of the whole subject, were these. That all trading operations were better conducted by private enterprise than by Government. That no evidence was adduced to prove that the Post-office could carry parcels cheaper than a public company, and, indeed, the Government must resort to public companies to carry the parcels from town to town. That, at the proposed rates, the public would have to bear the first cost and establishment charges required to establish the Parcels Post—such as the cost of the new buildings and *matériel* necessary for its proper organisation, as well as the annual expenditure till the returns were sufficient to defray it, and this was in fact making the public bear a portion of the trade expenses of those traders who would use the post for the delivery of their small parcels. That it would place in the hands of the Government an important monopoly for the benefit of the few who sent and received parcels, as well as a great increase of patronage of the most objectionable description. On all these grounds, therefore, he said this Society, the fundamental principle of which was to encourage the greatest freedom in Arts, Manufactures, and Commerce, ought to oppose a measure calculated to benefit the few at the expense of the many—which had every character of a monopoly, and to support which evinced a want of confidence in that public spirit and enterprise upon which this country had hitherto so safely relied, and from which it had derived morally, commercially, and politically, the greatest advantages.

Mr. Harry Chester said, he, in common, he believed, with his colleagues in the Council, had listened with interest to what had fallen from Mr. Hawes; and whether he was in favour of the measure or against it, he (Mr. Chester) knew that, if Mr. Hawes took upon himself to criticise it, he would so exhaust the subject that nothing more could be said against it. He had waited that he might see whether there were really the dreadful objections that he had been told would be brought against this measure. He was one of those who thought they were very much indebted to the gentlemen who had originated this idea, and especially to the Committee who had embodied their views in the report that had been read. He hoped that no one in that room disputed the principle laid down by Mr. Hawes—that Government should not enter into competition as traders. Although until recently he had himself been a Government officer, he had always been of opinion that Government ought not to do for the people anything which the people could do for themselves, but this was a thing which the public could not do for themselves, and that fact was proved by the circumstance that up to this day they had not done it. They were told that in most large towns there were generally some means—if the people knew it—of sending parcels from one end of the country to the other, with comparative security, but not with speed. If people did not know that they could so transmit their parcels, and if speed was the essence of the service, and not only speed but certainty of delivery, these he held to be arguments in favour of this measure. He would give an illustration within the experience of the Council. In the conducting of the Society's Examinations they had to make certain that on several successive days sets of papers sent from London should arrive simultaneously at 32 different places. It was the essence of the competition in the examinations, that those papers should not arrive at any one place before the proper time, but that they should arrive at the time when the subject of the paper was going to be worked, and that the parcels in which they were sent should be opened in the presence of the candidates assembled at the different places. The Council made all the inquiries in their power—and their opportunities of inquiry were not small—and they came to the conclusion that there was no agency which they could trust in this service, but that of the Post-office. Consequently, the Council, at considerable expense, sent out the sets of papers through the post, and the result was that, without a single exception, the parcels arrived at the right places at the right time; which service could not have been effected by any other organization in this country. It was an easy matter to excite popular prejudice against what was called Government interference. What would be the interference in the measure proposed? They already had the Government carrying on a service analagous to that which they now wanted with regard to small parcels. Every argument that Mr. Hawes had used against the small parcels being conveyed and distributed under the organization of the Post-office, went equally to the point that they ought to take out of the hands of the Government the transmission of letters and book parcels. What was the difference between a letter and a parcel? A letter was merely a parcel of paper written upon; and a book parcel was merely a parcel of papers printed upon. Were their liberties in danger because they sent a small watch by post instead of a letter or a book! They found that Government had a very good though still incomplete organization. There were many places where post-offices were not established so near the places where the letters had to be delivered as they might be, but that was being improved; and all they suggested was that the same person who carried the letters should be allowed to carry small parcels. When they talked about bandboxes, that was done in the good old times, to which Mr. Hawes appeared so much attached. Of course a reasonable limit would be placed upon the size of parcels so transmitted. If he wanted to send a small parcel to an old lady living in a small village a few miles from Doncaster, under the present system he would have to send a letter by post to say that the parcel—say a box of pills, was coming. One person would deliver the letter, and another person would deliver the box of pills. Mr. Hawes seemed to think, if that circuitous method were not maintained, the railway companies would be ruined, and the liberties of the people of this country endangered. They did not propose to injure the railways, on the contrary, they proposed to benefit them. What was the reason that the railways did not carry more parcels? In the first place, there was the collecting the parcels, and secondly, the difficulty of delivering them. The Post-office had machinery as perfect as it well could be for collecting the parcels, and the railways would carry larger parcels of goods than they had ever done before. It seemed to him that this was a want which was felt by everybody, and they must class this proposal with many others in former years, which met with great objection from those "*laudatores temporis acti*," but which ultimately had been carried into successful operation by the good sense of the majority, as he felt convinced this measure would be. In fact he believed that every few years would pass over their heads before the public mind, when duly informed upon the matter, would demand that this useful reform should be brought into operation.

Mr. Edwin Chadwick, C.B., would not be inclined to compliment Mr. Hawes, to the extent which Mr. Chester had done, upon the character of his speech, which he thought was more suited to the political platform than to the discussions of this Society. In the case now before them it was the people who proposed to dictate to the Government, and not the Government to the people. The Government had not tyrannised over the people by enforcing the penny postage, but it was the universal demand of the country that brought about that system; and what they now required was that Government should do that which they could do with little additional trouble, viz., render a public service in which no private interests would be interfered with. He had recently been in Switzerland, and had made inquiries as to the working there of this very system which Mr. Hawes so much dreaded; and he had there heard many expressions of astonishment that any doubt could exist in England as to the utility of the measure now proposed. When talking with a merchant of Zurich upon this subject, he was met with an expression of surprise that Englishmen, who were proverbially so wise in commercial matters, should be so stupid as to have any doubts upon this question. In Switzerland the rates were something like half or one-third of what was proposed in this country, and the system answered perfectly. He might observe that some of the statements of Mr. Hawes were unwarranted by the facts. He had talked of a huge monopoly. There was no notion of monopoly in the plan. They never imagined that in those cases which now existed, where people could send parcels for a halfpenny per lb., any one would be so foolish as to go to the Post-office and pay fourpence, or that it would interfere with the existing large parcels traffic. It was confined to those exceptional cases for which there must be separate messengers under the present system of transit or delivery. It was said, in opposition to this measure, that the demand would be so extraordinary that it would embarrass the business of the Post-office. What was that but an admission that there was a great public want to be supplied? He had been told by the vice-chairman of one of the large railway companies, that, after due consideration of the Report by the directors, they had seen the urgency of the arguments of Mr. Rowland Hill—that on the whole this system would not interfere with the traffic of the railway, and many were of opinion that it would be a benefit to it. He was not aware of any opposition to the plan on the part of the railway companies; but of exaggeration they had had a plentiful supply that evening from his friend near him (Mr. Hawes). It was a great fact in support of the views of the Committee, that the plans had been submitted to the various Chambers of Commerce of the country, who, he believed, had generally expressed themselves favourable to it, and he ventured to place the opinions of those commercial bodies against those of his friend Mr. Hawes. On the other hand, there had been a great deal of suspicion evinced by country tradesmen that the system would clash with their local interests, from the facilities that it would afford for getting articles from London tradesmen; but, at the same time, it would tend in other ways to promote the trade of remote districts. With regard to the pecuniary part of the question, they proposed to leave that to be determined by the judgment of the Post-office authorities; and, under the present management of that establishment, they might rely that the interests of the public, as well as those of the service itself, would be duly consulted. They proposed simply to submit it to the Post-office to make the regulations in accordance with their own convenience. He was aware that if this public demand arose, new premises must be had at the central office. He considered that the views of the Committee had been responded to by the most competent authorities that the plan could be referred to, and he regarded that response as expressive of the general sense of the community upon the question.

Sir Thomas Phillips felt bound to say, without adopting all the views of his friend, Mr. Hawes, that he thought it behoved them to consider whether it was a fit policy that the Government of this country should, either voluntarily or by pressure from without, enter upon any branch of the business of the country which could be transacted by private individuals. He apprehended that no one would wish to see the Government competitors for the business of common carriers unless it were for some exceptional reasons. He apprehended, also, that no one would object to further utilizing a power that at present existed, or an office already established, if it was understood that they intended to extract from the existing machinery a larger amount of public benefit than had hitherto been obtained. But did any one who advocated this report, and who sought to carry it into practice, mean to limit himself to that extent of operation? Would they believe that the little extra work that they could get out of the village letter-carrier would be at all commensurate with the extent of business which they assumed would be done by the Post-office if they became common carriers? He apprehended it was nothing of the kind; but that they meant that the Post-office of this country should be largely increased, its mechanism improved, and that it should conduct an amount of operations for which at present it was wholly unequal. If that were the case, it became a serious question whether that public department should employ the taxation of the country in order to carry out, at less cost and with greater convenience, our parcel traffic. This was a subject to which he had given but little consideration; but he thought, as a principle, it ought to be very seriously considered before the government bound themselves to undertake the task proposed by this report. Some exaggerated statements had doubtless been made as to the effects of this system. No doubt there had been some exaggeration on both sides, and although he should hesitate very much in affirming the conclusions arrived at in the report, he nevertheless thought, with Mr. Chester, that they were under great obligations to the gentlemen who had investigated this matter, and had prepared this report. The facts therein stated were worthy of consideration, but they led to the all-important question—at what stage did they consider the duty of the Government ended, and the duty of individuals began?

Mr. Edwards said they had heard the statement that the Chambers of Commerce were favourable to this measure. He might be permitted to say, as a humble individual, connected with a party in this country who were at one time politically weak but were now strong, that almost every advocate of that party was opposed to increasing the power of the Government, or putting additional work into the hands of the Post-office authorities. He had no doubt, if this measure were carried, it would be a public convenience, but immediately that advantage was realised, an agitation would be got up to extend the system to parcels of greater weight than those contemplated by the Committee, until it came to the conveyance of passengers. In fact, the whole railway system of the country might pass into the hands of the Government, unless they placed some limit beyond which the system should never be extended.

Professor Tennant considered that improvements were required in the Post-office for increasing the facilities of the delivery of letters in London, and that the frequency of dispatches should be increased. He considered that a parcels post would be a great advantage if it could be carried out without interfering with commercial affairs of a more important nature.

Mr. S. W. Brooks said it ought to be mentioned, that whilst the Post-office was not liable for damage or loss of parcels, the railway companies were.

Mr. Peter Graham had but few observations to offer in reference to the discussion. An objection had been raised which he was not prepared to answer, namely, that under the proposed system, no one would pay more than fourpence for a letter. That was a question of the revenue of the Post-office, and he, for his part, should have no objection to the rates being reduced. With regard to the convenience which this plan would afford to persons engaged in trade, testimony had been afforded by one of the largest houses in the city—Copestake and Co., who were so convinced of the importance of the measure, that they had been in communication with the railway companies, endeavouring to get them to adopt some improved method of forwarding small parcels, and that having failed, they were convinced that what the Post-office could do in this matter could not be achieved by any other existing organization. That opinion was confirmed by other City houses, and by many large houses at the West-end. They had very easy and direct means of communication from London to Glasgow, for instance, but it did not apply to the wants of the country towns generally. Supposing they wanted to send a parcel from Wandsworth to a tradesman in the City, it would be a great convenience to drop it into a post-office and ensure its delivery for fourpence, instead of the uncertainty and delay of sending it by a carrier. Mr. Hawes had made a great point of the building of a new post-office. Of course that would be required; but he (Mr. Graham) conceived that the public money could not be spent for a better object than in promoting the public convenience, which would be paid for only by those who availed themselves of it. As to the weight and size of the parcels to be embraced in this system, it was obvious that a limit must be fixed both as to size and weight; in fact, the proposed price, 4d. per lb., was a practical limitation. All the difficulties of detail would doubtless be overcome by a man with the character for organization possessed by Mr. Rowland Hill. He did not consider that the railway companies would be injured in the least by this measure. The only parties who would suffer were those who were employed in the collection and delivery of the parcels, and they would most probably meet with employment under the new system. He thought the bugbear of Government interference, which had been raised by Mr. Hawes, was hardly worthy of that gentleman, when all that was proposed was to utilize and extend our existing establishment. The public would use the system only for their own convenience, and the carriage of parcels would be as free as it was at the present time.

The Chairman proposed a vote of thanks to Mr. Peter Graham, which was unanimously passed.

The Secretary announced that the paper for Wednesday evening next, the 2nd February, would be one by himself, "On Aluminium."

ON THE SALE OF CORN BY WEIGHT.

By J. T. Danson.

It has been publicly announced that, from the 1st of February next, grain, meal, and flour will be sold, in the markets of Liverpool, Glasgow, and Hull, only by the "cental" of 100 lbs. avoirdupois.

The effect upon these markets may be inferred from inspection of the following summary of weights about to be displaced, in the Liverpool market, by the "cental":—

				lbs.
Wheat has hitherto been sold per			....	70
Barley	,,	,,	....	60
Oats	,,	,,	....	45
Indian corn and beans		,,	....	480
Peas	,,	,,	....	504
Flour	,,	,,	196lbs. or	280
Oatmeal and Indian meal, per			196lbs. or	240

A similar (not identical) variety has prevailed in the markets of Glasgow and Hull; and still prevails in all the principal corn-markets of the United Kingdom.

The resulting evil is twofold—multiplicity of methods in the same market, and variety of methods in different markets; but it is most important in the latter aspect.

The main object of trade in corn may be said to be to equalise the price in different localities. Freedom of trade has its value in the facility it affords to the attainment of this object—its value alike to the producer, to the dealer, and to the consumer. The lowest price fairly attainable throughout the kingdom—the price best for all parties—would be an uniform price, or a close approximation to it; and this is just the price towards which every additional facility given to the corn trade helps us nearer, and to the attainment of which the exertions of every corn-dealer are constantly (however unconsciously) directed.

To take, first, the case of the dealer. The method of equalisation is invariable—it is transfer of corn from places in which it is cheap to places in which it is dear. This process has three parts:—1st, discovery of local inequalities of price; 2nd, negociation of a transfer; and 3rd, transmission of the required quantity of corn. Corn-dealers' profit is payment for performance, or direction, of these processes; and is palpably dependent upon the number and extent of the transactions effected. But both "number" and "extent" are reduced by every difficulty in the way of the transaction itself; and diversity of modes of sale undoubtedly makes more difficult what the corn-dealers are especially called upon to do,—to find out where corn can be bought cheapest and sold dearest; and, until these steps are taken, facilities of transmission are practically worthless. The cases of producer and consumer are disposed of with a moment's reflection. The transfer will only take place when its effect will be to reduce, in some degree, the average price of the kingdom. So much for the consumer. And it will only take place when its effect will be to raise, in some degree, the price of the particular corn dealt with. So much for the producer.

This evil of diverse measures is not a new one; but it has of late become more apparent, and less bearable, and hence is more heard of. It was felt enough in 1834 to induce the House of Commons to appoint a select committee "to inquire into the present practices of selling corn throughout the United Kingdom, with a view to the better regulation thereof." That committee examined many witnesses, and reported the existence in the country of a great diversity in the modes of selling corn: that in some districts sales were made only by weight, in others only by measure; and in others by both methods; that great inconveniences resulted: ever-recurring misunderstandings and disputes; markets ignorant of the state of, and disinclined to have dealings with, each other; fraud constantly facilitated; and published quotations of price commonly unintelligible out of their own locality. Nearly five-and-twenty years have elapsed, and, the diversity remaining nearly as it was, the ill effects of it have been largely increased. For, as to transmission, railways have, in the interim, reduced to one-half, or one-third, the effective distance between the markets; and as to communication, the electric telegraph has put them all within speaking distance of each other. It is now almost as bad as if the diversity existed in the same market.

The committee of 1834, seeking an uniform method, halted between weight and measure. They sat in London, and were no doubt made to feel, through the witnesses most readily producible, the bias of the London dealers in favour of their own long-established practice of selling by measure—a practice not adhered to the less firmly, perhaps, for its association with the metage-monopoly of the London corporation. Otherwise, even then, the invariable use of weight throughout Ireland, and its preference in the markets then serving more than half the population of Great Britain—a proportion probably now exceeding two-thirds—would doubtless have led them to choose weight. They chose neither; but proposed a compromise. This was readily shown to be impracticable; and the House dropped the Report into its waste-paper receptacle.

Three of the principal markets of the kingdom, long accustomed to sale by weight, have now determined to use only one denomination—100 lbs. avoirdupois, which they have named the "cental." It is said by some that this is illegal. Were it so, it might be observed that the law has been equally broken, time out of mind, wherever, in Great Britain, corn has been sold by weight; for the law has precisely the same relation to the Scottish boll (240 lbs.), the Welsh hobbett (168 lbs.), the Birmingham bushel (62 lbs.), and the Liverpool bushel (70, 60, or 45 lbs.) as to the cental (100 lbs.). But, in truth, there is no illegality in selling anything by any number of pounds avoirdupois; though the view of the statute (5 and 6 William IV. c. 63) adopted by some of the Scottish authorities, seems to favour that notion.

Assuming that the new system finds general favour in the corn-trade, when tried, there is, apparently, but one obstacle to its extension into every market in which sale by weight is or shall be adopted, and that is the want of stamped weights (and to use others is clearly illegal) convenient for making up the cental, or aliquot parts of it, in the scale. To use the present weights, 56, 28, 14, 7, and so on, will draw somewhat more largely upon the mental arithmetic of the weigher, than would a set running 50, 25, 10, 5 lbs., and so on. But if, to remove this inconvenience, resort be had to Parliament, those who seek the suggested change will find ample support in the documents of the highest authority on this subject yet laid before either House.

The commissioners appointed in 1838 (after the national standards of weight and measure had been destroyed in the burning of the Houses of Parliament), "to consider the steps to be taken for the restoration of the standards of weight and measure," after stating in the report (presented to Parliament in 1841) that—

"The decimal scale of division appears to us to be by far the most convenient for all transactions which become the subjects of written accounts, and for all transactions, of whatever kind, in which great numbers of weights and measures are combined by addition or multiplication," proceed to offer the following recommendations:—

"That after the expiration of the year commencing next after the passing of the Act [proposed by the commissioners], weights of 14 lbs., 28 lbs., 56 lbs., 112 lbs., or any of their multiples, except those occurring in the decimal scale hereinafter mentioned, be not legal for the sale of any commodity whatever, or for the purpose of weighing for any other commercial transaction; and that such weights be then liable to seizure by the inspectors of weights and measures, and to fine, in the same manner as false or defective weights.

"That the only legal weights, above one pound, be weights of multiples of one pound, not exceeding ten pounds; and weights of ten pounds and its multiples, not exceeding one hundred pounds.

"That the name *centner*, or some other, to be fixed by Act of Parliament, be recognised as describing the weight of one hundred pounds, without the necessity of further definition.

"That the Government do consider the expediency of some plan of exchange, by which the weights of 14lbs., 28lbs., 56lbs., and 112lbs., now in use, may be withdrawn, and weights of 10lbs., 20lbs., 30lbs., 40lbs., 50lbs., and 100lbs., may be substituted for general use."

This report having been published and discussed, another commission was issued, in June, 1843, authorising the construction of new standards, under the best scientific superintendence. The resulting report was presented to Parliament, and published, in 1854. From that report we extract the following consecutive paragraphs:—

"We wish to state our opinion that, in reference to the decimal scale generally, the public mind is very greatly changed, and that the introduction of a decimal system will now [1854] be very easy in respect to many points which a few years ago would have offered great difficulties.

"We desire next to refer to our letter of 1853, March 26th, expressing the hearty wish of every member of the committee that measures might be taken, at the present favourable opportunity, for commencing a coinage on the decimal scale, descending from the pound sterling.

"We advert briefly to the notorious fact, that the Bank of England has spontaneously adopted a decimal scale of multiples and subdivisions of the troy ounce, for weighing gold and silver, in which the Bank has been followed by the Royal Mint, and by bullion dealers in general. A bill to be laid before Parliament for the legalization of this scale was prepared by the Bank of England, and was submitted to us. The bill was approved by us, and, having passed through Parliament, has now become law.

"We are anxious also to call your [the Treasury's] attention to the circumstance that, in the Custom House of London, it has been found necessary to adopt a series of weights in the millesimal scale of subdivision of the avoirdupois pound, in order to facilitate the calculations of tare upon ribbons and other goods in numerous small packages, upon which duty is payable on the net weight only.

"We beg leave to refer to the letter of our chairman, under date of 1853, April 21, proposing that the customs duties which it was then contemplated to levy by the hundred weight of 112 lbs., should be changed into equivalent duties levied by the hundred pounds [the cental] of 100 lbs.; and we remark that under any circumstances this step would be convenient; but that if, as we trust, a decimal coinage shall shortly be established, the convenience would become so striking that the change could not very well be deferred. This measure would almost necessarily imply the adoption, in the Custom House, of weights of 10lbs., 20lbs., &c., and 100lbs. (a series which, even without a change of tariff, the officers of that establishment are desirous to introduce), and we do not doubt that the adoption of these weights by the public would soon become so general that, if they were not already recognised by law, it would speedily be found necessary to pass an Act of Parliament recognising them."

It may now be said that the anticipation of the Commissioners ("the adoption of these weights by the public") is about to become an accomplished fact. Perhaps it may also "speedily be found necessary to pass an Act of Parliament" such as they have suggested. Meanwhile, the best test of the expediency of "the cental movement" will be found in the progress it makes among those it most concerns. The best course for its friends will obviously be to let it speak for itself.

Eldon Chambers, Liverpool.

THE LIVERPOOL INSTITUTE AND THE LONDON MECHANICS' INSTITUTION.

At the annual meeting of the Liverpool Institute, the sum of £50 was voted from the surplus income towards the Donative Fund now raising to refound and endow the London Mechanics' Institution. The subject formed part of the annual report, and on the motion of William Brown, Esq., M.P., was unanimously adopted. The following passage in the report of the directors shows that the subject has had the sympathy and consideration of the directors, and the unanimous approval of the members of the Liverpool Institute:—

"London Mechanics' Institution.—The subject of the London Mechanics' Institution and Lord Brougham's responsibility as its trustee, have been brought under the consideration of your directors. They cannot but think that it would be a reflection on the friends of education generally if the noble lord, who fought the great fight for popular education, and won it, were allowed to bear the annual loss which he has rendered himself liable to by his zeal for the welfare of the people. It is with pleasure, therefore, that your directors observe the effort which is now being made to relieve Lord Brougham from all pecuniary responsibility. To mark their approval of the step, as well as to express the deep sense of respect they entertain for the labour of the noble lord, your directors have unanimously resolved to recommend that the sum of £50 from the funds of this institution be placed to the credit of the fund which is now being raised in London. Lord Brougham laid the foundation-stone of this institution; he has on several occasions cheered your directors by his sympathy, and instructed the members by his addresses. In grateful acknowledgment of what he has done, not only for this institution but for the country, your directors heartily commend this resolution to your approval."

Home Correspondence.

THE SUPPLY OF COTTON.

SIR,—In answer to the letter of Mr. Bridges Adams, I must first disclaim the possession of more common sense or humanity than the rest of my fellow townsmen, Manchester men, in my opinion, being both practical and humane, and this question far too important to be trifled with.

My wish in all matters with which I have to do, is to take advantage of existing circumstances, as far as possible, and turn them to practical account.

My first step, therefore, was to try to show to the chiefs and other Africans in the interior, that it would be more profitable, and to their interest generally, to employ their people than to sell them into slavery, as they were in the habit of doing. I then pointed out how they might employ the whole of their people in the cultivation of cotton, and in shipping it to this country, instead of allowing it to fall and rot on the ground, as it then did, from season to season, except what was required for domestic use.

I then furnished the means for the purchase of whatever was brought for sale, however much or however small in quantity.

The quantity offering soon became large, but, difficulties arising, I was induced to arrange to teach a number of Africans how to conduct the whole of the operations, and the Rev. Henry Venn, of the Church Missionary Society, kindly undertook to select suitable youths from the missionary school at Sierra Leone.

Henry Robbin, who now has charge of the Industrial Institution at Abbeokuta, was first selected; then the well-known and much-valued African clergyman, the Rev. Samuel Crowther, sent over his son Josiah; and a tradesman of Sierra Leone sent one of his sons also. The two first were placed at my mill, in the country, there to learn the method of cleaning the cotton, the nature and use of machinery, how to handle their tools, and get their own living.

The third was placed in my office, in Manchester, with a view only to a mercantile education.

With regard to the use of their fingers, as Mr. Adams expresses it, I may safely say, that for the time they were employed, and the age at which they commenced (17 to 19), we never had any young people who excelled them.

With regard to their conduct in general, it was most exemplary, and as to Robbin, the clergyman of Tyldesley certified to the Rev. Henry Venn, that he was the best of his Sunday-school teachers; and I believe they merited and obtained the respect of the other mill hands, as well as of the inhabitants of the village at large.

Everything being strange and new to them, and their services being wanted in Africa, their occupation was changed almost weekly; consequently they were longer in earning wages. Robbin worked twenty-two weeks without wages; six, at five shillings per week; twenty, at seven-and-sixpence; thirty at eight shillings; sixteen at ten shillings; and again several months at the end without any wages, going from workshop to workshop, to obtain a knowledge of the construction of roofs and other operations connected with the erection of buildings,—the turning of bed-posts, walking-sticks, ornamental articles, the construction and working of cotton gins, packing presses, &c., &c. In fact, his attention was directed to everything that I considered likely to be useful to him in his own country, more than to obtaining wages whilst here, and in every case he acquitted himself most creditably.

Crowther worked twenty-four weeks without wages; six at five shillings per week; twenty-six at seven-and-sixpence; twenty-seven at eight shillings; and one at ten shillings, when he was taken ill, and had to return very hastily to his own country, having both worked and conducted himself entirely to the satisfaction of our manager, myself, and my partner, whilst here.

The other youth came as an office-boy for three years, at the rate of ten pounds for the first year, twenty pounds for the second, and thirty pounds for the third year, and was employed in my Manchester warehouse.

He was clever enough, and might have done well, but owing to his love of dress and society, *and being made too much of*, he was led into expenses which his father could not afford, and was obliged to return to Africa sooner than was intended. My opinion is that it would be folly to attempt to bring Africans over to work our mills, so uncongenial as our climate is to their physical constitution, few of them being able to stay here over the third winter; but, as to expertness and general ability, I unhesitatingly say (from the specimens tried) they are in every way capable of doing all we require.

With regard to working mills in their own country, I think that also premature; for whilst, perhaps, a hundredth part of the land is not cultivated, and can be had for the asking, or, at most, for a trifling present, whilst cotton in every part spontaneously abounds, and whilst the prolific, industrious, docile, and intelligent African equally abounds, why should he not at home turn to those agricultural pursuits that he has hitherto been coerced to in similar climates elsewhere?

By cultivating simply the indigenous products of his native country, he would rapidly supply those very articles by which slavery is now supported at a much lower rate, making slavery thereby unprofitable, if not ultimately impossible.

As Mr. Adams says, Africa being so near to us, we should look to it for whatever it can produce; for the cost of bringing articles from many countries is in itself prohibition, and yet, near as it is, the shippers have never charged me less for freight than a penny per pound upon the gross weight of cotton, whilst it is brought from many parts of the world, twice the distance, for less than half that amount.

I quite agree with Mr. Adams that nothing could so rapidly civilise any part of the world, as a continued succession of young people coming to this country to be instructed in all the appliances of civilised life.

A few days before being asked to preside at the readings of Mr. Wray's able paper on Cotton, I had arranged with the Rev. H. Venn to get over three more African youths, and to take them to my mill to get a similar training to those who were formerly there, and I feel confident that ere this the estimable Bishop of Sierra Leone is trying to select from the missionary schools such boys as will do credit to Africa.

Indeed, I may say here, and I trust I have done so on all occasions, that without the kind aid, able advice, and assistance of Mr. Venn and those who act with him, I could have done comparatively nothing; although what has been done (Receipts, 1815 bales in 1858) is but a drop in the ocean. The African Native Agency Committee (with whom Mr. Venn is connected) have, in all cases, paid the expenses over the earnings, of all Africans they have hitherto brought, and again engage to do so for those that are now coming; and they estimate the cost at about 15s. per week for the whole time they are required to be here.

Being pleased with the result of my efforts, a kind friend has come to my aid, and I have now lying in Liverpool, waiting for shipment, upwards of three thousand pounds worth of machinery and requisite materials to enable me to go further into the interior of Africa, establish new cotton stations, and prosecute the matter with still more vigour. As any and every one will purchase cotton now that a large profit arises, my object is more than ever to open up new sources of supply.

That coming to this country has a beneficial effect upon the individual African, may be easily shown by the fact that Henry Robbin, who lately worked for 5s. weekly (and probably for 2s. in his own country), has, since returning, refused one hundred pounds per annum at Abbeokuta.

The benevolent friend before named has also enabled me to place at Dr. Livingstone's disposal a sum of money sufficient for him to carry out his wish of assisting me in my first and great object—Christianising, civilising, and elevating Africa, supplying our own deficiency in cotton, and, as far as possible, superseding slavery.

In furtherance of these objects the Bishops of Sierra Leone and Natal are cordially lending a helping hand, by advice, influence, and encouragement, and our Cotton Supply Association is calling forth the energy of the people and the government of Liberia by offering prizes and medals for successful cultivation of cotton.

Several liberal friends have kindly enabled Mr. Wood, the Tunisian Consul, and myself, to establish a Cotton Growing Company at Tunis, one-half the capital, at least, being found by Tunisians, with a government guarantee against more than a certain portion of loss should the Company prove a failure; and although the seed was too late, and the whole of the land (eighteen hundred acres) could not be sown, yet some of the cotton looks well, and shows that Tunis can grow good cotton, both in colour, staple, and cleanness. Apologising for the length of this letter.—I am, &c.,

THOMAS CLEGG.

Manchester, Jan. 22nd, 1859.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Prof. Huxley, "On Biology."
Actuaries, 7. Mr. Day, "On the Probabilities of Marriage, as affecting the Calculations of Premiums for Assurance against Issue."
Medical, 8.
United Service Inst., 8. Mr. F. J. Evans, Superintendent of the Compass Department, Admiralty, "Notes on the Magnetism of Ships and the Mariner's Compass."

TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8.
Pathological, 8.
Photographic, 8. Anniversary.

WED. ......London Inst., 3. Mr. T. Rymer Jones, "On the Natural History of the Vertebrate Division of the Animal Kingdom."
Society of Arts, 8. Mr. Le Neve Foster, "On Aluminium."
Geological, 8. Mr. G. Poulett Scrope, M.P., "On the Formation of Volcanos and Craters."
Pharmaceutical, 8.
Royal Soc. Lit., 8½.

THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Royal Soc. Club, 6.
London Inst., 7. Mr. G. MacDonald, "On the Poetry of the 16th Century."
Antiquaries, 8.
Linnæan, 8. Mr. Bentham's "Notes on British Botany, continued—Geographical Distribution."
Chemical, 8.
Artists and Amateurs, 8.
Royal, 8½.

FRI.........United Service Inst., 3. Colonel H. James, R.E., Director of the Ordnance Survey, "The Ordnance Survey: its Operations, Organization, and Series of Maps and Plans produced."
Archæological Inst., 4.
Royal Inst., 8½. Prof. Owen, "On the Gorilla."

SAT. ......Asiatic, 2.
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 21, 1859.]

Dated 3rd December, 1858.

2766. E. S. Jones, 13, Marylebone-street, Golden-square—Imp. in cornets, trumpets, horns, and similar musical wind instruments.

Dated 21st December, 1858.

2916. A. S. Beliard, Bordeaux, France—An improved machine for pumicing felts, tissues, and skins.

Dated 27th December, 1858.

2954. J. Radley, 22, Upper Sackville-street, Dublin—An improved cooking apparatus.

Dated 30th December, 1858.

2984. H. C. Vion, Paris—A new mode of obtaining atmospheric electricity, and terrestial electricity, and its industrial applications, and in apparatus for the same.

Dated 31st December, 1858.

2999. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production of boots and shoes or other coverings for the feet, and in machinery or apparatus employed in such manufacture. (A com.)
3001. M. D. Wyatt, Guildford-street, Russell-square—Imp. in tiles and tessaræ and other wall coverings, and in the means of securing the same to walls and buildings.
3003. J. Lees and W. Heap, Park-bridge, near Ashton-under-Lyne, Lancashire—Imp. in machinery for punching square holes in the ends of rollers and other articles.
3005. F. W. A. Casper and G. H. Schmahl, 152, Rue du Faubourg St. Martin, Paris—Using spart or Spanish broom in manufacturing seats of all descriptions.
3007. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production and casting of steel, and in the apparatus employed therein. (A com.)

Dated 1st January, 1859.

1. J. T. Pitman, 67, Gracechurch-street—An improved mode of making and fitting bungs to casks and other vessels. (A com.)
2. H. C. Traphagen, New York, U.S.—Imp. in skirts for ladies.
3. A. Anderson, Lancaster, U.S.—An imp. in governors for machinery.
4. B. J. Gosteau, 2, Rue Ste. Appoline, Paris—An improved gridiron, which may form a complete cooking apparatus.
5. J. E. Drouot, 2, Rue Ste. Appoline, Paris—Imp. in bakers' ovens.
6. W. Footman, 15, Water-street, Strand—Imp. in breaks for retarding and stopping railway trains, carriages or other vehicles.
7. J. Oliver, White Bank, near Chesterfield, Derby—Imp. in lubricators for steam engine cylinders.
9. J. Garforth, Dukinfield, Chester—Certain imp. in steam engines.
10. H. Ashworth, Littleborough, Lancashire—A certain imp. in power-looms for weaving.
11. R. Smith, Beith, Ayr, N.B.—Imp. in casting, applicable to printing surfaces, and for other purposes.
12. P. E. Guérinot, 60, Boulevart de Strasbourg, Paris—Imp. in the application of an apparatus to railway locomotives, waggons and carriages, for the purpose of lessening the effect of concussion in the event of collision.
13. W. Eccles, 34, Surrey-street, Strand, Westminster—Improving the machinery or apparatus for regulating the tension of the twist threads or warp whilst it is weaving in power looms into cloth.
15. A. Prince, 4, Trafalgar-square, Charing-cross—Imp. in the construction of cylindrical presses. (A com.)
16. W. A. Von Kanig, Leipsic, Saxony—Imp. in machinery or apparatus for digging and cultivating land.
17. J. Harris, Hanwell, Middlesex—Imp. in apparatuses for regulating the pressure and flow of steam, water, and other fluids.
19. G. Skinner, Stockton-on-Tees, Durham, and J. Whalley, South Stockton-on-Tees, Yorkshire—Imp. in the manufacture of ornamental and other tiles, and other similar articles.
20. J. Brown, jun., Rotherham, Yorkshire—Imp. in buffers, draw springs, and bearing springs.
21. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in machinery for forming dough into cakes or break crackers. (A com.)
22. A. L. Lévèque, Paris—An improved apparatus for subduing or stopping runaway or restive horses.
23. J. B. Morgan, Liverpool—Imp. in propelling navigable vessels.

Dated 3rd January, 1859.

24. J. Luis, 1B, Welbeck-street, Cavendish-square—New economical candles. (A com.)
25. R. Tempest and J. Tomlinson, Rochdale, Lancashire—Imp. in certain machines for preparing cotton and other fibrous materials.

27. C. B. Blyth, Dundee—Imp. in machinery for preparing and treating jute, hemp, flax, and other fibrous materials.
29. W. Renton, T. Renton, and W. Binns, Leeds—Imp. in raising the nap or pile of textile fabrics.
30. J. Furnival, Leamington, Warwickshire, T. Furnival, Cobridge, J. Derbyshire, Longton, and F. J. Emery, Burslem, Staffordshire—Imp. in apparatus for supporting articles of china and earthenware in kilns and ovens.

Dated 4th January, 1859.

31. L. J. Higham, Edmund-place, London—Improved means for obtaining submarine electrical conduction.
32. J. Buchanan, Greenock, Renfrewshire, N.B.—Imp. in oil cans or lubricating apparatus.
33. J. B. Joyce, Bradford, Yorkshire—Imp. in means, machinery, or apparatus applicable to wool combing.
34. W. Hood, 68, Upper Thames-street—Imp. in racks and water cisterns for stables.
35. A. Bedborough, Southampton—An improved chimney cowl and ventilator.
36. C. de Forest, Leicester-square—An imp. in the manufacture of springs for carriages, and other uses. (A com.)

Dated 5th January, 1859.

37. F. Clark, King-street, Bloomsbury—Imp. in connecting knobs and handles to the spindles of locks and latches, and other articles of a like nature.
38. W. Draper, 2, Gordon-terrace, Holland-road, Brixton—Imp. in machinery for printing on paper and other fabrics.
39. J. Howard, Bedford—An improved construction of lever-neck plough.
40. R. Rumney and W. S. Macdonald, Manchester—Imp. in printing and dyeing woven fabrics and yarns or threads.
41. A. V. Newton, 66, Chancery-lane—An imp. in the process of and improved apparatus for separating metals from their ores. (A com.)

Dated 6th January, 1859.

43. J. Kirkman and I. Grundy, Bolton-le-Moors, Lancashire—Imp. in certain kinds of bed covers or counterpanes, and other textile fabrics of similar character, and in the mode or method of weaving the same.
44. G. Bury, Everton, near Liverpool—Imp. in part or parts of apparatus commonly used and applied for effecting the pick in power looms for weaving.
45. H. G. Coombs, 17, Union-street, Borough—An improved method of constructing railings, bars, gates, gratings, columns, and all other builder's work of a like nature or description.
46. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for preparing cotton and other fibrous materials to be spun. (A com.)
47. W. Renton, T. Renton, and W. Binns, Leeds—Imp. in finishing woollen and other fabrics.
48. J. Aspinall, Great Tower-street—Imp. in machines for the manufacture of bolts, rivets, and spikes.
49. J. H. Johnson, 47, Lincoln's-inn-fields—An improved textile fabric, applicable to the manufacture of varnished cloths, and to other purposes. (A com.)
50. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for boring, piercing rocks, applicable also to the dressing or working of stone, and as a power hammer generally. (A com.)

Dated 7th January, 1859.

51. W. Spence, 50, Chancery-lane—Imp. in the mode of taking photographic pictures on wood. (A com.)
53. E. Heywood, Halifax—Imp. in weaving.
55. G. K. Geyelin, London—Regulating gas burners, which he calls the Universal Gas Burner Regulator.
57. J. Paterson, Wood-street—An imp. in bands and belts for the waist.
59. W. E. Newton, 66, Chancery-lane—Imp. in machinery for winding, twisting, and doubling fibrous materials. (A com.)

Dated 8th January, 1859.

61. C. F. Vasserot, 45, Essex-street, Strand—An improved chain and bucket pump. (A com.)
63. T. B. Hubbell, Castle-street—An improved trap for rabbits, rats, mice, and other like animals and vermin. (A com.)
66. A. W. Williamson, University College, London—Imp. in condensers for steam engines and other purposes.
67. W. Clark, 53, Chancery-lane—Imp. in purifying natural phosphates of lime. (A com.)
69. J. T. Forster, Holland-road, Kensington—Imp. in bed berths, applicable for bunks, hammocks, cots, and other fixed and moveable sleeping places.
71. W. A. Lyttle, Secretary's Office, General Post Office, London—Taking the place of springs in many, if not all, of the combinations into which they enter, and also for equilibrating a varying force or weight.

Dated 19th January, 1859.

73. L. A, Normandy, jun., 67, Judd-street—Imp. in the process of distilling and clarifying resinous substances. (A com.)
75. F. Lehr, Hoboken, New Jersey, U.S.—Imp. in machinery for manufacturing metallic ribs for umbrellas, parasols, and other articles.
77. J. White, Finchley—Imp. in cleansing or purifying air, and in increasing or reducing the temperature thereof, and in the application of air so treated to sanitary and other uses.

Dated 11th January, 1859.

79. E. Agneni, 29, Devonshire-street, Queen-square, Bloomsbury—Increasing particularly the effect of decorative pictures, landscapes, drawings, and prints, through looking glasses.
81. J. Biers, jun., 38, Rochdale-road, Kentish-town—A self-acting carriage wheel brake.
83. W. Tillie, Londonderry—An imp. in the manufacture of shirts and shirt fronts.
85. B. J. Rubenstein, London—Imp. in dentistry.
87. C. W. Siemens, John-street, Adelphi—Imp. in supports for electric telegraphic line wires, and in tools or apparatus to be used in the construction of such supports, part of which imp. are applicable to the joining of pipes and other articles.
89. N. P. Burgh, Sheerness—Imp. in steam-engines.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Jan*. 21, 1859.]

January 21st.

1529. A. W. Sleigh.
1645. M. Matley.
1651. D. W. Warder.
1658. H. Higgins and T. S. Whitworth.
1662. H. Barber.
1671. J. F. Belleville.
1625. C. F. Vasserot.
1697. A. Kellermann.
1698. A. Pougault.
1832. W. Knowles.
1915. T. Averill.
2672. F. J. Calvert & C. Lowe.

[*From Gazette, Jan*. 25, 1859.]

January 25th.

1676. A. Sax.
1678. J. Hardie.
1683. E. Jones.
1684. H. Jackson.
1687. P. A. Godefroy.
1688. H. Glover.
1691. J. Emes.
1693. A. Taylor.
1694. C. N. Kottula.
1696. G. Hurn.
1705. H. Harden.
1711. J. Musgrave.
1713. G. S. Parkinson.
1715. J. L. Hinks.
1740. C. de Bergue.
1749. W. B. B. Harvey.
1774. J. B. Pascoe and J. R. Thomas.
1783. D. McCrummen.
1784. C. Mather.
1799. J. Smith, Jun.
1802. J. Imray.
1803. J. Taylor.
1843. H. Smith & T. W. Ashby.
1849. T. Rickett.
1945. A. V. Newton.
1967. L. Wiart.
2186. J. T. P. Newbon, T. Smith, and J. Brown.
2450. S. Bottomley.
2609. B. Rider.
2643. J. Young.
2661. W. Warne, J. A. Jaques, and J. A. Fanshawe.
2681. C. Mather.
2753. E. L. Benzon.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, January* 21, 1859.]

January 17th.

142. F. J. Manceaux.
163. J. B. P. A. Thierry, jun., J. L. Richard, and Baron H. de Martiny.
171. J. Francis.

January 18th.

197. F. Chauchard.

January 19th.

181. J. Hopkinson, jun.
203. J. Beads.
227. P. E. Guerinot.

[*From Gazette, Jan*. 25, 1858.]

January 20th.

160. J. W. Robson.

January 21st.

162. P. L. Tieffe-Lacroix.
218. W. Beasley.

January 22nd.

193. G. B. Pettit and H. F. Smith.
250. C. F. Claus.

WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4145	January 3.	Cart, Van, and Waggon Pulley Tail	A. McDougall	17, Addle-hill, St. Paul's Churchyard, [E.C.
4146	,, 5.	The Hibernian Mantle	J. Lee	54, Dame-street, Dublin.
4147	,, 6.	An Improved Fastener for Sashes and other purposes	P. Currie	Summer Hill Works, Birmingham.
4148	,, 6.	The Kensington Brace	W. Blenkiron	23, Wood-street, Cheapside, E.C.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 4, 1859.

EXAMINATIONS, 1859.—NOTICE TO CANDIDATES.

In reference to the five subjects referred to in the note to Par. 22 of the Examination Programme for this year, which states that no papers will be set in Navigation and Nautical Astronomy, in Astronomy, in Botany, in Agriculture, or in Political and Social Economy, unless returns are received before the 1st of February, that ten candidates are preparing themselves in these subjects for the Previous Examination, the Council hereby give notice that papers will be set in Botany and in Political and Social Economy, but that no papers will be set in Navigation and Nautical Astronomy, in Astronomy, or in Agriculture.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Chelmsford.

Mr. Edward Copland, Chelmsford.
Mr. Horatio Piggot, solicitor, Chelmsford.
Mr. Daniel Wheeler, surgeon, Chelmsford.
Rev. George Wilkinson, Chelmsford.
Mr. William Cutts, Chelmsford, *Secretary.*

For Halifax.

Rev. J. H. Gooch, Heath Grammar School, Halifax, *Chairman.*
Mr. A. Baldwin, Barum-top, Halifax.
Mr. S. Baldwin, Milton-street, Halifax.
Mr. T. Barraclough, Trinity-place, Halifax.
Mr. J. Barrowby, Booth-town, Halifax.
Rev. R. L. Carpenter, B.A., Milton-place, Halifax.
Mr. L. Child, the Shed, Haley-hill, Halifax.
Mr. Thomas Cordingley, Ringby, near Halifax.
Dr. Garlick, F.R.C.S., Lord-street, Halifax.
Mr. G. Gibb, 6, Corporation-street, Halifax.
Mr. S. Hartley, Bowling Dyke Mill, Halifax.
Mr. J. D. Hutchinson, Hampden-place, Halifax.
Mr. Joseph Jennings, Black-wall, Halifax.
Mr. Thos. Midgley, Bowling Dyke Mill, Halifax.
Mr. B. Musgrave, 5, Greenhill-terrace, Halifax.
Mr. E. Taylor, Horton-street, Halifax.
Mr. G. Whitely, B.A., Fergusson-street, Halifax.
Mr. A. C. Forster, solicitor, Halifax, *Secretary.*

For King's Lynn.

The Mayor of Lynn.
Mr. W. Cooper, High-street, Lynn.
Mr. R. Cruso, New Conduit-street, Lynn.
Rev. F. L. Currie, Clenchwarton, near Lynn.
Mr. Henry Edwards, Goodwin's-fields, Lynn.
Mr. W. Everard, King-street, Lynn.
Mr. F. Kendle, Nelson street, Lynn.
Mr. Joseph Kerkham, High-street, Lynn.
Mr. Walter Moyse, King-street, Lynn.
Mr. James Nurse, King-street, Lynn.
Mr. F. R. Partridge, Littleport-street, Lynn.
Mr. Lionel Self, Nelson-street, Lynn.
Mr. W. Taylor, High-street, Lynn.
Mr. Henry Wells, High-street, Lynn.
Mr. J. G. Wigg, Saturday Market, Lynn.
Rev. Canon Wodehouse, St. Ann's-street, Lynn.
[The above gentlemen form the Council of the Athenæum.]
Rev. E. F. E. Hankinson, St. John's-place, Lynn.
Rev. W. Leeper, Goodwin's-fields, Lynn.
Dr. Lowe, King Staith-square, Lynn.
Mr. Lupton, New Conduit-street, Lynn.
Rev. E. Price, London-road, Lynn.
Mr. J. T. Wigner, London-road, Lynn.
Rev. T. White, Master of the Grammar School, Lynn.
Mr. T. Burton, 23, South Everard-street, Lynn, *Secretary.*

For Macclesfield.

Mr. T. U. Brocklehurst, The Fence, Macclesfield, *Chairman.*
Mr. James Birch, Park-lane, Macclesfield.
Mr. E. Chadwick, Hibel-road, Macclesfield.
Mr. R. Higson, Crompton-road, Macclesfield.
Mr. Wm. Partington, James-street, Macclesfield.
Mr. S. Rushton, Macclesfield.
Mr. W. Smale, Park-lane, Macclesfield.
Mr. Thomas Smith, Brook-street, Macclesfield.
Mr. Wm. Taylor, High-street, Macclesfield.
Mr. C. Thompson, Oxford-road, Macclesfield.
Mr. D. B. Curwen, Park-grange, Macclesfield, *Secretary.*

For Newcastle-on-Tyne.

Rev. W. R. Burnett.
Rev. James Henderson.
Rev. C. W. N. Hyne.
Rev. James Snape, Royal Grammar School.
Mr. Joseph Forster, Church of England Institute, *Secretary.*

For Northowram.

Rev. S. R. Eddy, B.A., Coley, near Halifax.
Mr. J. O. Greenwood, Quarry House, Northowram.
Mr. W. H. Lord, Spring House, Shelf.
Mr. W. Moore, Northowram Hall.
Mr. J. W. Wood, Mountain, Shelf, near Halifax, *Secretary.*

For Pembroke Dock.

Mr. Robert Saunders.
Mr. J. Walker.
Mr. F. Allan, *Secretary.*

For Sheerness.

Mr. R. Crockford, Beach-street, Sheerness.
Mr. W. Henwood, Exeter House, Mile Town, Sheerness.
Mr. J. Road, 7, Edward-street, Banks Town, Sheerness.
Mr. W. B. Robinson, Navy-terrace, Sheerness.
Mr. S. Willcocks, Chapel-street, Mile Town, Sheerness.
Mr. H. Morgan, 36, James-street, Marine Town, Sheerness, *Secretary.*

NINTH ORDINARY MEETING.

Wednesday, Feb. 2, 1859.

The Ninth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 2nd inst., Thomas Graham, Esq., F.R.S., Master of the Mint, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bower, John Abigal
Dilke, Ashton W.
Dodge, N. S.
Gouldsmith, George
Haywood, Thomas Burt
Henry, Michael
Lamb, Lieut. Henry
Neil, Edward Bernard
Sargenson, W. Sugden
Smith, Henry
Smith, Wm. Ackers
Somes, Joseph
Tress, Richard

AS AN HONORARY CORRESPONDING MEMBER.
Romberg, Edward.

The following Institution has been taken into Union since the last announcement :—

Wolverhampton, Working Men's College.

The Paper read was—

ON ALUMINIUM.

BY P. LE NEVE FOSTER, M.A., Secretary of the Society of Arts.

The ancients held that all material substances could be resolved into four undecomposable bodies, viz., air, earth, fire, and water ; our modern chemists have not only shown that these are no elements at all, but that there are upwards of fifty substances which science at the present day recognises as incapable of being decomposed. Air is shown to be composed of two elementary bodies, oxygen and nitrogen; water, of hydrogen and oxygen. Fire is no substance at all ; rather one the of phenomena which heat exhibits ; and in what category heat itself is to be placed, is a matter about which the learned are not agreed. As for earth, the fourth element of the ancients, we all know that this consists of a variety of earths, each of which, by the later discoveries of the chemist, has been shown to be the oxide of a metal. The main constituent of one of these earths is alumina, the oxide of the metal aluminium. Aluminium, in one form or another, is distributed in the utmost profusion throughout the whole composition of our globe, so far, at least, as the crust of the earth is concerned. There is probably no other metal which is so abundant, or which plays a more important part in the world's economy ; not, indeed, in its metallic form, but in combination with other substances. In combination with oxygen and silicium it forms the essential portion of our granite rocks, which geologists look upon as the very foundation of our soil. Feldspar, one of the main characteristic constituents of granite, is a double silicate of alumina and potash. It is present in our slates and in schist; but, above all, in all those immense beds of various descriptions of clay, which play so important a part in agriculture and in the arts. It is scarcely possible to conceive any more important influence than that which the compounds of aluminium exert in relation to our daily wants and comforts. The silicate of alumina is essential to the composition of the clays ; take this away and you have no longer clay. Without clay what would become of the fertility of our fields, its impermeable beds retaining the water which soaks down to them, forming wells and reservoirs for water. Without clay, where would be our pottery, bricks, materials for the furnaces of our factories, hydraulic cements for our docks and canals ? Without alumina what would become of our dye works ? for it is this all-important substance which enables us to fix the rich and varied colours on our silks, our wools, and our cottons. In the preparation of skins it also is largely used.

Aluminium forms an essential portion of a large number of our most brilliant gems. The corundum, which almost rivals the diamond, is pure alumina ; coloured blue it becomes the sapphire ; red it takes the name of the Oriental ruby, and yellow it is known as the Oriental topaz. The Oriental amethyst and Oriental emerald are varieties of the corundum. Emery, too, is a coarse variety of the corundum.

But, however abundant these earths, and however largely diffused over the face of our globe these ores of aluminium may be, it must not be imagined that aluminium itself is therefore readily obtained ; indeed, till within the last half century, the very existence of such a metal was not even thought of, much less its extraction. It is to the deep researches and labours of Davy that a knowledge of the earthy metals is due, many of them having been discovered by him, and though he himself did not actually produce aluminium from alumina, yet it was ultimately obtained by others working on the discoveries which he had initiated.

In close connection with these earthy metals are the alkaline metals, sodium and potassium, the basis of the alkalies soda and potash ; and as these substances—more especially sodium—play a very important part in all the practical processes for obtaining aluminium at the present day, I will ask your attention while I enter shortly upon the history and the means which are now adopted for their production.

Sir Humphrey Davy, in a paper read before the Royal Society, in 1807, made known his discovery of the alkaline metals. He employed what was then a novel agent, voltaic electricity, and by its means decomposed both potash and soda, producing their metallic bases, potassium and sodium. For those important discoveries, on which the science of modern chemistry may be said to have taken its rise, the French Academy conferred upon Davy the prize of 50,000 francs offered by the Emperor Napoleon for researches in electricity. But though Davy did not succeed in separating by electricity aluminium from its compounds, yet electricity was the means of obtaining it by chemical decomposition, it having been the first source from whence sodium and potassium could be obtained. In this manner, however, they could be produced only in very small quantities, and at an enormous cost. Gay-Lussac and Thénard afterwards made researches in reference to these metals, and succeeded in producing them by direct chemical reaction, but still only in small quantities as laboratory experiments. Subsequently their researches were carried further by Mitscherlich, Brunner, Donny, and Mareska ;* and, following and improving on their labours, M. Deville,† in France, liberally supplied with funds for the purpose by the present Emperor of the French, to carry out researches for the production of aluminium, succeeded in producing sodium in large quantities, and at a price which, though high, was reduced sufficiently low to enable it to be employed in the production of aluminium, at a cost which admits of its commercial use in the arts for certain purposes, though too high for general use. To enter at length into the description of the methods adopted by M. Deville would occupy too much of your time. Those who are desirous of entering more minutely into these methods, will find them detailed in the papers by M. Deville, in the Annales de Chimie indicated in the notes. They may be described shortly as consisting of heating at a high temperature a mixture of carbonate of soda, coal dust or charcoal, with chalk, in an iron vessel, when certain re-actions take place, and the sodium, which is very volatile, comes out in vapour, which, by means of receivers of a suitable form, is condensed, and then runs out in a continuous stream into vessels placed to catch it. It is through the modifications introduced by M. Deville in the forms of the receivers, and the introduction of chalk into the process—which seems to facilitate the reduction in a remarkable manner—that the production of sodium has been rendered more easy and less costly.

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* Recherches sur l'Extraction du Potassium, par MM. J. Mareska et F. Donny. Ann. de Chimie, ser. 3, tom. xxxv., p. 147.

† Recherches sur les Métaux, &c. Ann. de Chimie, ser. 3 tom. xliii. p. 19, et Memoire sur la fabrication du Sodium et de l'Aluminium, par M. H. Sainte-Claire Deville. Ann. de Chimie, ser 3, tom. xlvi. p. 415.

I have dwelt, in the first instance, on the production of sodium, because it plays an all-important part in the reduction of aluminium itself, as will be hereafter shown. It may be shortly stated, in round numbers, that it requires, according to theory, about three parts of sodium in order to produce one part of aluminium, and hence the absolute necessity for a cheap production of sodium in order to get cheap aluminium. Though Davy has succeeded in obtaining, through the agency of the galvanic battery, the metallic bases of other earths, he failed in producing aluminium from alumina, nor was he able to produce it chemically by the reaction of potassium. Berzelius and Oersted were not more fortunate in their attempts, until the latter hit upon the expedient of converting the alumina into chloride of aluminium, and then treating it with the alkaline metals. Wöhler* repeated the experiments of Oersted, but it was not until he had materially modified the process, that he was successful in obtaining the metal from the chloride of aluminium. In 1854, Deville, assisted, as I before said, with funds from the Emperor Napoleon, took up the subject, and it is to him that we owe the vast improvements in the process which have enabled the metal to be produced in quantities and at a price permitting it to be brought partially into use commercially. Until this time the production of the metal was simply in very small quantities, the result of laboratory experiments. Deville showed how it might be produced on a large scale, and at a very considerably reduced cost. The previous experimenters had used potassium as the reducing agent. Deville substituted for it sodium, a metal somewhat easier of production, less difficult in manipulation, and, above all, having for its chemical equivalent 23 instead of 39, and therefore rendering the use of little more than half the quantity of this expensive material necessary to produce the same amount of aluminium; and as the main element of expense in the process was the amount of alkaline metal employed, this, as well as the improvements which he introduced in the manufacture of the sodium itself, as has before been shown, was a very important step in the practical production of the metal. Deville also felt convinced that the platinum vessels which Wöhler employed affected the properties of the aluminium produced, and he substituted vessels of porcelain with success. To produce the chloride of aluminium, Deville forms a mixture of alumina (prepared by calcining ammoniacal alum), and charcoal, made into a paste, with oil, which is heated to a red heat in upright tubular retorts of fire-clay, similar to those used in the manufacture of gas for lighting purposes; and whilst in this state a current of chlorine gas is caused to pass into the retort, when chemical reactions take place, and the chloride of alumina comes over in the form of vapours, and is received in appropriate vessels, where it is condensed. The following is the method adopted by Deville for reduction of the metal from the chloride, and is thus described by the Rev. John Barlow, F.R.S., the Secretary of the Royal Institution, in a paper read before the members of that body in 1856, when Deville was present, and assisted in performing the experiments with which that lecture was illustrated:—

"A tube of Bohemian glass, 36 inches long, and about one inch in diameter, was placed in an empty combustion-furnace, constructed for the purpose. Chloride of aluminium was introduced at one extremity of the tube; at the same extremity a current of dry hydrogen gas was made to enter the tube, and was sustained till the operation was finished. The chloride was now gently warmed by pieces of hot charcoal, in order to drive off any hydrochloric acid it might contain; porcelain boats filled with sodium, were inserted into the opposite extremity of the tube; the heat was argumented by fresh pieces of glowing charcoal until the vapour of the sodium decomposed that of the chloride of aluminium. Intense ignition usually attends this reaction. At length the aluminium was liberated in buttons, which were found in the boat adhering to a substance consisting of the mixed chlorides of aluminium and sodium. The boat was now transferred, with its contents, to a porcelain tube, through which hydrogen gas was passed. At a red heat, the double chloride distilled into a receiving vessel, attached to the tube for the purpose; the buttons of aluminium were collected, washed with water, and subsequently fused together under a flux consisting of the double chloride.

"Another method of obtaining aluminium from the chloride has been adopted with success. It is as follows:—

4·200 grammes of the double chloride of aluminium and sodium (*i.e.*, 2·800 grammes chloride of aluminium, and 1·400 grammes common salt),
2·100 grammes of common salt,
2·100 grammes of cryolite,

thoroughly dry, and carefully mixed together, are to be laid in alternate layers, with ·840 grammes of sodium (cut into small pieces), in a crucible lined with alumina —a layer of sodium should cover the bottom of the crucible When the crucible is filled, a little powdered salt is to be sprinkled on the contents, and the crucible, fitted with a lid, is to be introduced into a furnace, heated to redness, and kept at that temperature until a reaction, whose occurrence and continuance is indicated by a peculiar and characteristic sound, shall have terminated. The contents of the crucible, having been stirred with a porcelain rod, while in their liquified state—(this part of the operation is essential)—are poured out on a surface of baked clay, or any other suitable material—the flux, &c., on one side, and the metal on the other." The cryolite here used is simply employed as a flux.

The process above described was by no means adapted for the production of the metal on a large scale commercially.

M. Paul Morin, who with M. Debray assisted M. Deville in his original researches, now uses at his factory at Nanterre certain modifications which he has introduced into Deville's process of the double chloride of aluminium and sodium, and gets rid of the necessity for the continued stream of hydrogen gas, as well as the use of the porcelain tube as above described. I believe it is due to M. Morin to state that it was he who first modified Deville's process so as to admit of the use of the crucible instead of the tube, thus enabling the manufacture to be carried out on a much larger scale.

Dr. Percy, in 1855, suggested the use of the mineral cryolite, which is a double fluoride of aluminium and sodium, as the ore from which the metal might be obtained, and accordingly in his laboratory at the School of Mines, experiments were made by the late Mr. Allan Dick, and a small piece of metal thus produced was shown at a meeting of the Royal Institution, accompanied with a few words of explanation by Faraday. Mr. Dick, in a communication to the "Philosophical Magazine,"* thus describes the process:—

"The first experiments were made in glass tubes sealed at one end, into which alternate layers of finely-pounded cryolite and sodium cut into small pieces were introduced, and covered in some instances by a layer of cryolite, in others by one of chloride of sodium. The tube was then heated over an air-gas blowpipe for a few minutes, till decomposition had taken place, and the product was melted. When cold, on breaking the tube it was found that the mass was full of small globules of aluminium; but owing to the specific gravity of the metal and flux being nearly alike, the globules had not collected into one button at the bottom: to effect this, long-continued heat would be required, which cannot be given in glass tubes, owing to the powerful action of the melted fluoride upon them. To obviate this difficulty, a platinum crucible was lined with magnesia, by ramming the same hard in, and subsequently cutting out all but a lining. Into this, alternate layers of cryolite and sodium were placed, with a thickish layer of cryolite on the top. The crucible was covered with a tight-fitting lid, and heated to redness for about half an hour over the air-blowpipe. When cold, it was placed in water, and after soaking for some time, the contents dug out, gently crushed in a mortar, and washed by decantation. Two or three globules of aluminium, tolerably large considering the scale of the experiment, were obtained along with a great number of very small ones. The larger ones were melted together under chloride of potassium."

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* Annales de Chimie, &c., 1 ser. tom. xxxvii, p. 66.

* Philo. Mag., 4th series, vol. 7, p. 364.

Rose, of Berlin,[*] about the same time experimented on the cryolite, and although he succeeded in obtaining the metal, he says:—"I never succeeded in reducing the whole amount of metal contained in the cryolite; it contains only 13 per cent. of aluminium; by operating on 10 grammes of the mineral, the quantity I have always employed, in small iron crucibles, the most successful result was 0·8 gramme. But 0·6 gramme, or even 0·4 gramme may be considered favourable. Many times I obtained only 0·3 gramme or even less." He goes on to say: —"The small amounts I obtained, however, should not deter others from pursuing these experiments. These are the results of first experiments, on which I have not been able to expend much time. Now that cryolite can be procured at so very moderate a price, and sodium, by the improvement in the preparation of which Deville has performed a most important service, will in future become so much cheaper, it is in the power of every chemist to employ himself in the preparation ef aluminium, and I have no doubt in a short time methods will be found affording a much more profitable result." "For the rest, I am of opinion that cryolite is the best adapted of all the compounds of aluminium for the preparation of this metal. It deserves the preference over chloride of aluminium and chloride of aluminium and sodium, and it might still be employed with great advantage even if its price were to rise considerably."

This cryolite[†] is found only in Greenland, and is furnished by nature in a rare state of purity, the aluminium being combined in it with sodium and fluorine only, neither of which exercise any prejudicial influence on the preparation of the metal. Care, however, should be used in selecting it, as many specimens contain ores of other metals.

Deville appears to have experimented with the cryolite, and adopted the following process of reduction. The cryolite is reduced to powder, and mixed with half its weight of common salt; this mixture is placed in an earthenware crucible, in layers, alternately with plates of sodium, until the crucible is nearly full. The last layer should be composed of cryolite alone, and covered with common salt. It is rapidly heated to perfect fusion, and then left to cool. The mass should be well stirred with an earthenware rod. On breaking the crucible, the aluminium is frequently found in large globules, easily separated. It always contains a portion of silicium. Deville gives no result of this process as to quantity, nor does it appear that the cryolite process has been generally adopted in France commercially, either by Deville or others, who have taken up the production of this metal, though Messrs. Tissier have carried it on, as I am informed, to some extent in their factory at Amfreville, near Rouen, but with what results I am unable to state. The process they adopt is the one which I have described above, save that they use a reverberatory furnace for the heating of the crucibles. The advantages they state are, that cryolite is not altered by the action of the air, whilst the double chloride of aluminium and sodium alters rapidly, and in the manufacture gives off deleterious gases, whilst it is necessarily high in price. Cryolite, on the contrary, is cheap, is unaffected by the air, is more easily worked, and without any deleterious fumes. The residuum, too, in the latter case, is said to be valuable. The fluoride of sodium which is formed can, it is said, at a very trifling expense, be readily converted into caustic soda, or carbonate of soda, which will repay the original cost of the cryolite. The process usually adopted in France is that which I have described above as Deville's, by means of the double chloride of aluminium and sodium, with the modifications which have from time to time been made by Morin and others, as experience has shown them to be important.

Mr. Gerhard, an Englishman, has for some little time past been engaged in experiments in reference to the cryolite process, with a view to establish the manufacture of aluminium in this country, and to produce it at a still cheaper rate than hitherto. He has adopted the cryolite process as a cheaper means of supply of the metal rather than the double chloride of aluminium and sodium, inasmuch as the cryolite is readily obtainable in large quantities, and at a very low price, whilst the double chloride of aluminium and sodium necessary for Deville's process is an artificial product, somewhat costly to prepare. Mr. Gerhard has erected furnaces at Battersea for the production of this metal, as well as of sodium, the necessary agent in the reduction of the ores; and there is no reason to doubt that with the modifications which he has introduced into the process, added to the fact that the materials for the production of sodium are cheaper in this country than in France, aluminium may be produced here at a still lower price than in France, whence the small quantity that has been used in this country has hitherto been imported.

Mr. Gerhard's process, which I have had the pleasure of seeing in operation at his works in Battersea, may shortly be described as follows:—270 parts by weight, of powdered cryolite, are mixed with 150 parts of common salt, and into this mixture are placed 72 parts of sodium, cut into small pieces. The whole is then thrown into a heated earthenware crucible, previously lined with a melted mixture of cryolite and salt, which mixture is also immediately poured over the contents of the crucible, covering them to some little depth, over which the lid is then placed. The crucible is then put in a furnace, and kept at a high red heat for about two hours. When the pot is uncovered the melted mixture is well stirred, and then poured out. The buttons of aluminium are found mingled with the slag, and may be easily melted together by heating them in a crucible with common salt. Theoretically, the amount of aluminium produced should be one-third of the weight of the sodium employed, but practically such a result is never obtained, and our manufacturers would be well satisfied with obtaining between one-third and one-fourth. This Mr. Gerhard has accomplished, though he is not always so successful. There is still some uncertainty in the process. From what I have seen, and from what I have learnt from those better qualified to judge on matters of chemistry and metallurgical operations than myself, I am led to believe that the cryolite process is the one that will ultimately be preferred to that of the chloride of aluminium. As yet, however, the process presents certain difficulties which Mr. Gerhard appears to have to some extent overcome by his method of performing the operation. I am sure he will have the hearty good wishes of every member of the Society that he may succeed in his labours to introduce a new industry into this country.

The price of this metal previous to the researches and labours of Deville was such as to render its production a simple curiosity for the scientific, and its employment in the arts, notwithstanding its valuable properties, was absolutely out of the question. Deville tells us that sodium was at one time sold as high as 1000 francs the kilogramme, and aluminium at a correspondingly high rate; these were, however, fancy and not commercial prices.

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[*] Philo. Mag., 4th series, vol. 7, p. 233.

[†] Quarterly Journal of the Geological Society, vol. 12, p. 140.

Previous to Deville's labours aluminium sold at the rate of 1000 francs for the kilogramme, or £40 sterling for 35 oz. avoirdupois; and when Deville came to England, in 1856, the result of his labours had then already caused a reduction in the price to 4s. per oz. for sodium, and £3 per oz. for aluminium. Mr. Gerhard already manufactures sodium commercially, and I believe it is due to his labours that the price of sodium has been considerably reduced. Sodium is now sold in this country at 16s. per pound avoirdupois, and two years ago the price of imported sodium was £6 sterling per pound. Aluminium, imported from France, fetches 7s. 6d. per oz., and there is no doubt that if large quantities of it were required the supply would be made at once at a considerable reduction on this, which may be termed a retail price. Looking at the enormous reduction which has in so short a time been made in the supply of this material, still manufactured on a comparatively small scale, there can be no reason to doubt that ultimately, and that probably at no distant period, it will be produced at a cost which will secure its application to numerous important uses. I may add here, that while engaged in the preparation of this paper, I have been informed, and I have no reason to doubt the truth of my information, that certain modifications are likely to be introduced into the manufacture of sodium, so as to enable it to be produced at a marvellously reduced price, which will effect in a proportionate degree the cost of aluminium.

I will now call your attention to the properties of this remarkable metal. One of its most striking properties is its extreme lightness, its specific gravity being 2·6, nearly that of glass, whilst that of platinum is 21·5, gold 19·5, silver 10·5, copper 8·96, zinc 7·2, tin 7·3; and in comparing its price with these metals this quality must be taken into consideration. Thus, for instance, in comparing it with silver, the bulk of a given weight of aluminium is nearly four times that of an equal weight of silver, and hence it will go nearly four times as far in the production of any article of commerce. Thus if one ounce of silver is required to make a spoon or any other article, the same weight of aluminium will make very nearly four such articles of equal size.

The metal is malleable, ductile, almost without limit; it can be reduced to very thin sheets, or drawn into very fine threads. Its tenacity, though superior to that of silver, is less than that of copper; but no very accurate experiments have been in this respect.

When pure, it is about as hard as silver. Its elasticity is not great. It files readily, and is said not to injure the file. It conducts electricity with great facility, so that it may be considered as one of the best conductors known, almost equal in this respect to silver, and more than eight times a better conductor than iron. It melts at a temperature a little above that of zinc, between zinc and silver. In its chemical qualities it would seem to take an intermediate rank between what are termed the noble metals and the common metals, being, as Deville states, one of the most unalterable of metals.

It might be imagined that it would as readily reassume its oxygen as it parted with it with difficulty when in a state of oxide. This, however, is not the case; it appears to be as indifferent to oxygen as either platinum or gold. In air and in oxygen it undergoes no sensible alteration, and it even resists it at the highest temperature which Deville could produce in a cupelling furnace, a temperature higher than that employed in assaying gold. Water has no action, according to Deville, on aluminium, neither at its ordinary temperature nor when boiling, nor even upon the metal at a low red heat, near its melting point. According to Professor Crace Calvert, this statement must be received with some degree of caution, as in experiments he has made he considers that oxydation does take place slowly where the metal is immersed in water for any considerable length of time. It is not affected by sulphur or sulphuretted hydrogen, like silver, nor is it acted upon to any considerable degree by any of the oxy-acids in the cold; nitric acid, whether strong or weak, at its ordinary temperature, in no way affects it, though when boiling it acts upon it slowly. Small grains of aluminium, plunged in sulphuric acid for three months, remained apparently unaltered. The vegetable acids, such as acetic, oxalic, and tartaric acids, have scarcely any effect on it at all. The true solvent of the metal is hydrochloric acid, which attacks it rapidly. It appears to resemble tin when brought into contact with hydrochloric acid and the chlorides. Its absolute harmlessness permits of its being employed in a vast number of cases where the use of tin would not be desirable on account of the extreme facility with which that metal is dissolved in the organic acids. But the effect of common agents on the metals in general use has been little studied. It is, however, known that if we boil for a very short time a solution of common salt in a silver crucible, a quantity of the metal is dissolved, sufficient to render the salt water alkaline, evidenced by its rendering red litmus paper blue. Sheet tin, heated for a few minutes in a solution of common salt, acidulated with acetic acid, is dissolved to a considerable extent, and this effect must constantly be taking place when mixtures of salt and vinegar are used in our cooking utensils; but as tin has little or no effect upon our bodies, and the salts are almost tasteless, the presence of tin in our food is not noticed.

Figuier, in his Scientific Year Book for 1858, just published, states that the caustic alkalies, potash and soda, and even ammonia, dissolve aluminium sensibly. He also states that common salt and acetic acid (vinegar), especially when mixed, attack and dissolve aluminium. He adds that the mixture of salt and vinegar for seasoning a salad, made in a spoon of aluminium, feebly but inevitably attacks it.

All these points, however, deserve to be inquired into, as there seems some discrepancy between different writers on them.

Through the kindness of my friend Professor Bleekrode, of Delft, I am enabled to show the meeting a specimen of aluminium procured from Paris, which is in a perfectly decayed state from having been immersed during five months in a solution of ordinary soap, such as is used for washing. He states that the result is quite different from oxydising or rusting.

Aluminium, like iron, does not unite with mercury, and scarcely at all with lead. It, however, forms a variety of alloys with other metals. It can be alloyed with iron, and when aluminium becomes cheaper it will be curious to see what effect mixtures of this metal with iron will have upon its quality, whether for good or for evil. It seems to unite readily with zinc; alloys of 100 parts zinc, with 10 or 25 parts of aluminium, have a lower melting point than zinc, and these have been found to give the best promise as solders for aluminium; but, unfortunately, when melted neither of them are sufficiently liquid, and do not run readily. The joints made will not bear a blow. A variety of alloys with nickel have been made, and that consisting of 100 parts of aluminium and 3 of nickel is found to work readily, and to have gained hardness and rigidity, as compared with the pure metal. The alloys, however, with copper are the most striking; they are light and very hard, and capable of a fine polish. In the same degree that copper adds to the hardness of aluminium, so does the latter, when used in small quantities, give hardness to copper, without, however, injuring its malleability. It renders it susceptible of a fine polish, and, according as the proportions are varied, the colour of the alloy becomes that of deep or pale gold. Alloys of copper with five and ten per cent. of aluminium, resemble gold perhaps more than any other metallic alloy hitherto employed. They do not tarnish sensibly by exposure to the air. Aluminium can be deposited by the battery, and by the same agent it can be gilt or silvered.

Looking at the various remarkable properties which this metal possesses, it is impossible not to see an immense variety of uses to which it may be applied. Already its lightness and colour has brought it into use for jewellery and ornaments of various kinds, bracelets, combs, pins, seals, penholders, tops of inkstands, porte-monnaies, shirt studs, harness, statuettes, candelabra, candlesticks, &c. Its ductility and fusibility render it readily stamped and cast. It works easily under the graver, and being unaffected by the atmosphere it has an advantage over silver. Its lightness renders it peculiarly fitted for spectacle-frames, eye-glasses, telescopes, and opera-glasses, to which uses it has alrealy been largely applied. It does not stain the skin as silver does. The alloys, too, or aluminium bronzes, as they may be termed, are peculiarly fitted, from the readiness with which they are worked, and their not changing under the action of the atmosphere, for the wheelworks of clocks and chronometers, as well as for the cases, too, for which the metal itself, also from its lightness, is peculiarly fitted.

Spoons, forks, drinking vessels, and covers for glass vessels may be made of it, which, even at the present price of the metal, will be much cheaper than silver, while they even possess in a higher degree those qualities for which silver has hitherto been prized. Figuier suggests its use for theodolites, sextants, and surveying instruments which have to be carried by hand, and where, therefore, lightness is important. The adjusting screws of such instruments, which, when made of silver or brass, tarnish from the contact of the hand, might with advantage be made of aluminium. Professor Bleekrode informs me that the working of this metal has, at his suggestion, been taken up by Mr. Meyer, a jeweller, at the Hague, who, amongst other things, has had a small bell cast, the handle of which, as a casting, is equal to anything hitherto done in silver. Professor Bleekrode regrets that time has not admitted of his sending it for the inspection of the meeting. Mr. Meyer's experience shows that the metal works well under the hammer, is well suited for chasing and engraving, as well as for casting. He alludes to the want of a proper solder for uniting several pieces, and has been obliged to adopt riveting, as in Paris. It has already been used by the dentist as a substitute for gold, in stopping, as well as for fixing artificial teeth, both on account of its cheapness and lightness, but the accounts differ as to its fitness.

Mr. Harrington, a dentist in the Isle of Wight, in a paper which he read before the College of Dentists in October last, states that he has used aluminium successfully for dental purposes, and entertains a high opinion of it as a basis for artificial teeth. His experience shows that after wearing it for four months it underwent no apparent change, and was perfectly free from all taste or unpleasantness of any kind. He cautions those who may employ it to be careful in using other metals with it, as even when "wrought" aluminium is used as wire for rivets or any other purposes, a galvanic action is set up, and the wrought metal is rapidly decomposed, leaving the cast metal unaffected. The metal is highly sonorous, and for musical instruments it has been suggested as specially suited. Figuier, however, says that the saliva, by its alkaline matter and salts, corrodes the mouth-pieces; and that the same difficulty has been met with by dentists who have used it for stopping teeth. Experience will decide these points, on which it appears there are differences of opinion. It has been suggested that when sufficiently reduced in price it would be useful for the sheathing of ships, instead of copper, which is rapidly destroyed. For telegraphic communication its lightness and superior conducting power render it specially fitted. These are but a few of the uses to which this metal is applicable, and many more will be found, as soon as it becomes cheaper. Tubes are made of it.

The special qualities of this metal render it well adapted for coin; and, as soon as it can be obtained at a sufficiently low rate, it would make an excellent substitute for our copper coinage. Thus assuming that it can be produced for 5s. the ounce, the price of silver, then looking at its bulk as compared with silver, any coin the size of silver coin would be worth one-fourth of it, and hence an aluminium coin of the size of a fourpenny-piece would be worth one penny. Its lightness, too, would always render any mistake between it and silver impossible. A piece the size of a shilling would be worth threepence. If the price should get still lower, this would not be of any importance, the coins being tokens only, and not passing at their intrinsic value. That the price will be reduced below five shillings per ounce, is a matter which can scarcely be doubted, if we look to the enormous reduction which has been made in a very short time, and when we consider that the manufacture is as yet in its infancy. Let us not despair of its realising the price of copper, when I think I may with great safety predict that the Master of the Mint would not look upon it with disfavour.

Looking at what has already been accomplished in a few years in the production of this metal, both in quantity and price, from £60 sterling per lb. down to £6, the present price, and seeing that each day brings with it a further simplification of the process and fresh reduction of price, there is every reason to expect that at no very distant period the metal will be produced in large quantities and at very diminished rates of cost, so as to render it available for an infinity of industrial purposes. Again, we must not ignore the fact that a few sources only of the supply of this metal have hitherto been touched. There are the enormous beds of clay, containing an inexhaustible supply of this metal, literally at our feet. It is surely worth the while of energetic minds to turn their researches in this direction for a supply of this substance. It exists in a large proportion in the clays, and in some of them to the extent of one-fourth their weight. It is clearly within the range of chemistry to devise processes by which these sources of supply may be made available.

I have not entered into the chemical questions connected with the subject; it would have been impossible to have done so in the time limited to the paper, neither is it necessary. My object has been to bring before the meeting a short account of the history of this metal, the progress which has been making from time to time in its production, and at continually reduced cost; that great reduction in cost is daily going on, and the great probability, indeed I might say certainty, that it will be produced both abundantly and cheaply; to point out the very remarkable qualities of the metal, in the hope that by calling the attention of our metal workers to its value, it may ere long be introduced into our factories, and take its place among the industries of the country.

Towards the end of the last century, two philosophers might be seen watching the nervous twitchings of the legs of a dead frog. Surely there was nothing very promising in the future for their labours, but the result has been the marvels of the electrotype, and the wonders of the electric telegraph. A few years since, at one of the meetings of the British Association, there might have been seen a gentleman showing to his friends, as a curious toy, a fac-simile, which, by means of electricity, he had made of his visiting card, little dreaming that that was the beginning of the electrotype, which has added an entirely new trade to this country. I can well remember the first specimen of gutta percha being brought to England and laid before this Society. For a time it was neglected; its peculiar qualities were looked upon as of little value; little use was seen for them. One of its special peculiarities—its being a non-conductor of electricity, attracted little attention, whilst electricity itself was confined to the closet of the philosopher. We are all aware of the important part it plays in reference to that quality alone, now that electricity has become, if I may use the term, a commercial commodity. Yet what were the prospects of all these researches and labours, compared with the prospects which open up to our view when we contemplate the introduction of the remarkable metal to which I have called your attention this evening.

In conclusion, let me express my best thanks to the Master of the Mint for a medal which he has been good enough to have struck in aluminium to illustrate this paper; to Professor Bleekrode for a specimen illustrating the decomposition of the metal; to Professor Tennant for a beautiful collection of gems and minerals; to Messrs. Johnson and Mathey for specimens of the metal, its alloys, and articles made from them; to Mr. J. A. Franklin for articles manufactured from the metal; to Mr. Marshall for specimens of the metal in leaves; to Mr. Harrington for a specimen showing its applicability to dental purposes; to Mr. Whiskard for a case of jewellery made from the metal; and to Mr. Gerhard for specimens of sodium, cryolite, aluminium, and articles made from it.

DISCUSSION.

In answer to an inquiry whether he was aware of any experiments having been made as to the relative strength of aluminium compared with other metals, Mr. Foster replied that he did not know of any accurate experiments having been made; but he believed he might state that this metal had been found to be stronger than silver. With regard to the difficulty of finding a solder suitable for it, he had been informed that Mr. Warren de la Rue had made experiments with a solder composed of aluminium and cadmium, which seemed to promise well, but he was not acquainted with the details.

Mr. Edward Smith Marshall exhibited some thin leaves of aluminium, beaten out after the manner of goldleaf, some of which were stated to be of the 80,000th part of an inch in thickness, showing the remarkable malleability of the metal.

Professor Tennant said it might be interesting to those who were desirous of further investigating this subject to know that there was a plentiful supply of cryolite to be obtained from Greenland. Twenty-years ago he gave £2 or £3 for specimens which could now be obtained for sixpence or a shilling; and he remembered giving as much as £5 for specimens of the cryolite not larger than those which Mr. Foster had before him. In January, 1856, Mr. Taylor read a paper on this subject before the Geological Society, to which Mr. Foster had referred. It was then stated that cryolite was found at a place called Evigtok (which signified in the Esquimaux language a place of plenty), about 12 miles from the Danish settlement of Arksut. It formed a bed about 80 feet thick and 300 feet long. The cryolite was quite white on the surface, but at a depth of about ten feet was found to have a blackish hue, though free from foreign matter. He had placed upon the table a specimen of this cryolite, showing carbonate of iron and other metals in combination with it. There were also found in combination with cryolite crystals of tantalite, or oxyde of tantalum, sulphuret of molybdena, galena, which was rich in silver, yielding 40 ounces to the ton, blende, carbonate of iron, iron pyrites, fluor spar, felspar, quartz, mica, hornblende, and other minerals. Black cryolite, heated to redness, was found to lose about one per cent. (moisture and acid), the whole of its colour, and part of its translucency, becoming perfectly white, like that at the surface. Whilst referring to those minerals which contained aluminium in greater or less quantities, it was to be remarked that corundum furnished some of the finest gems that were known. The fine blue corundum was the oriental sapphire; the red, the oriental ruby. The gems of commerce, such as the common topaz and ruby, differed from those to which he had alluded, these being the coloured varieties of the corundum.

The Chairman said he quite agreed with Mr. Foster and M. Deville, that the place which aluminium held in the scale of metals was that of an intermediate metal between the precious metals and the commoner ones. He thought it rather stood at the head of the common metals than at the bottom of the precious metals; and M. Deville had pointed out the singular analogy which existed between it and iron. At first sight it did not exhibit much resemblance to iron, but it resisted the action of nitric acid in the same way that iron did, and was also somewhat magnetic, and acquired by pressure the elasticity of that metal. The most curious fact connected with it, perhaps, was its property of combining with carbon and silica. When this combination took place a substance was formed analogous to cast-iron, brittle and friable. The analogy of this metal with silver was indeed rather more apparent than real. The noble metal silver was reduced by heat alone, which was not the case with the oxyde of aluminium. It was possible that ultimately a lower oxide of this metal would be discovered, a protoxyde of aluminium analogous to the protoxyde of iron, which would doubtless admit of a great variety of applications.

Mr. Newton was desirous to know whether Mr. Foster had seen any instances in which aluminium had been employed for any of the purposes enumerated in the paper, such as wheels of clocks, sextants, and other mathematical instruments, or in any position in which there was any considerable amount of friction. It was important to know what effect friction had upon this metal. He conceived that aluminium would not be suitable for the joints of mathematical instruments that were subject to considerable abrasion, and even silver itself was found to be inapplicable to those purposes. Theodolites and similar instruments had been mentioned as one purpose to which aluminium, owing to its lightness, could be applied, but for some parts of these instruments gun metal was now employed, because brass was too soft for the purpose, and he very much questioned whether so soft a metal as aluminium was applicable to such purposes. For some articles, such as opera glasses and spectacle frames, he had no doubt it was very suitable.

Mr. Samuel May had given some attention to the manipulation of this metal, but he had found several difficulties connected with it, which he feared were insuperable in the application of it to many useful purposes. The great objection appeared to be that alluded to by the last speaker—that was its extreme liability to abrasion. There were, however, purposes to which this metal might be usefully applied, of which mention had not yet been made, and it struck him that it might supply a want which was very much felt amongst medical men—namely, a receptacle for caustic. Gold was generally employed for that purpose, but it was heavy and expensive. Within the last few years, palladium had been substituted for gold for this purpose, but the supply of it was very small. Aluminium seemed specially adapted for this purpose, owing to its power to resist the action of strong acids. The great difficulty was the want of some means of uniting the metal without the necessity for riveting. At present no solder had been discovered, and that was one great difficulty in the way of its application to many useful purposes. He had found, however, that aluminium held a good thread for a screw, and this method of union might, therefore, be employed in cases which admitted of it. He had no doubt that the scientific researches of the age would eventually overcome these difficulties, and he could assure those who were desirous of investigating the subject further, that it was one that would amply repay them for their labour.

Mr. Charles H. Smith remarked that a good deal had been said with respect to the cost of this metal. There was no doubt that any new metal was very expensive upon its first introduction, and even now, if any person wanted to procure an ounce or two of iron direct from the ore, and was not acquainted with the means which lengthened experience had taught them, it would be rather an expensive matter. When a new and useful metal such as this was discovered, it was impossible to set limits to the purposes for which it might ultimately be found to be applicable, and whenever its real value became known, enough of ingenuity would spring up to discover the means of producing it at a low rate. With reference to the question of cost, he could remember the time when the first lucifer matches were introduced, and it was then thought a great thing to be able to obtain 100 of them for a shilling, and they could now buy 10,000 for the same sum, and these of a very superior quality. If this metal could be supplied at a cheap rate, its peculiar properties would render it invaluable in supplying a great want in the present day—that was, a cheap and durable covering for the roofs of houses. At present slate and lead were employed for that purpose, but the former was very heavy, and the latter was not only very heavy, but open to other serious objections.

Mr. Foster would state, in reply to what had fallen from Mr. Newton, that he had not said that aluminium was itself suited for the wheels of clocks, but the bronze of aluminium and copper, which had been used for that purpose. He believed a watch with works made of this bronze was exhibited at the Paris Exhibition. A specimen of it, made by Dr. Percy, was sent to Woolwich Arsenal a year or two ago, and experiments were made upon it. It was found to be very hard, and much superior to the ordinary bronze of tin and copper. In fact, the observation was made that if it could be produced at a sufficiently cheap rate it would form an excellent material for cannon.

Mr. William Hawes said this was too important a subject to be dismissed with the few observations that had yet been made upon it, and he would refer to one or two subjects which struck him during the reading of the paper. The great object in bringing before the Society a subject like this was, not only to elicit facts in support of the statements made by the author of the paper, but also to bring out all the objections that could be adduced. Up to the present moment, all the opposition that had been made to the views of Mr. Foster, as to the probable introduction of this new metal for the ordinary purposes of life was, that there were no precisely ascertained facts as to its strength. It was suggested by one speaker that its softness rendered it unfit for certain appliances, and the meeting was led to infer that therefore it would not come into competition with the older and more common metals. Supposing it to have failed in the instance of the balance wheel of a watch, this ought not to induce a doubt that so important a discovery as this would have a considerable effect upon the mechanical arts of the country. Many years ago he was in the habit of bringing sodium from Paris for Professor Faraday. It was then difficult to obtain in this country, and the price he paid for it in Paris was £26 per pound, and it could now be procured for 16s., with every prospect of that price being yet considerably further reduced. If, therefore, they had had such a reduction in the price of a metal not so useful as aluminium itself, what might they not look forward to with regard to reducing the cost of this confessedly useful metal. The price had already been reduced from £5 or £6 to 7s. 6d. per ounce, and might they not infer that the 7s. 6d. would be reduced almost in the same proportion as had been the case with sodium, which fell from £26 to 16s. It was not of importance to consider at the present moment whether or not it was applicable for the works of a watch, there were so many other purposes for which it was adapted. They must not forget that, although this metal was now produced from a particular mineral brought from Greenland, it also formed the main constituent of the great bed of clay on which London rested. He thought they were very much indebted to Mr. Foster for the manner in which he had brought this interesting and important subject before them, and for directing particular attention not only to the valuable properties of the metal itself, but also to the progress that had been made in a very few years in reducing the cost of its production.

Mr. Robert Thomson said there were two statements made in the paper which appeared to be scarcely reconcilable with each other. He alluded to the circumstance mentioned by Mr. Harrington that, whereas aluminium had been applied to dental purposes, and had been in use for four months without oxydising, yet in the case of mouthpieces for musical instruments oxydation had been found to take place to a considerable extent.

Mr. Foster said that in reference to the latter statement he had quoted from a work just published by M. Figuier.

Mr. Thomson added that Mr. Harrington stated in his paper read before the College of Dentists, that if the aluminium were forged it would oxydise in the mouth, but if it were cast this would not occur. The difference might consist in the method of manipulation. It was also stated by Mr. Harrington that if any other metal—such as spiral springs of gold—came in contact with the aluminium in the mouth, a galvanic action took place, and destruction of the aluminium was the consequence. This had been obviated by insulation with tortoiseshell.

Mr. Strode mentioned that efforts were being made in Denmark to produce this metal in large quantities, for which purpose the cryolite was imported from Greenland. A friend of his, who was pursuing the subject, had asked him whether there was any means of disposing of the residue of the manufacture.

Mr. Palmer thought if this metal would admit of sufficient polish, it would form a valuable substitute, owing to its extreme lightness, for the tin and glass at present used for daylight reflectors. Another useful application of the metal, he thought, would be as a lining for packages for shipment, inasmuch as the lighter they were the less would the freight be. He had no doubt that in a few years it would take a place of equal importance in our manufactures to that which gutta percha had taken, and he thought they were very much indebted to Mr. Foster for having brought so interesting a subject before them.

Mr. Frederick Lawrence could not agree with the opinion that the only bar to the more general use of this metal was its high price. When it was at the price of £2 per ounce, people had said that if it could be reduced to 10s. an ounce, there would then be plenty of it used; but although it was now 7s. 6d. an ounce, it had not come into general use. One serious drawback was that it could not be joined by soldering; and further, he found that manufacturers were not likely to employ it for many of the purposes for which it had been suggested as applicable. One speaker had said that it would not answer for mathematical instruments; and another that it would not do for the wheels of clocks. At present they had not heard of any description of manufacture to which it was applied at the present price of 7s. 6d. per ounce, except, perhaps, articles of jewellery, such as those on the table. Silver was expensive, yet it was extensively employed in our manufactories; if, therefore, it was merely a question of price, why was not aluminium more generally used. Judging from the spoons exhibited, he thought there was little chance of this metal being used for that description of domestic article. He thought the value of this metal would be greater as an alloy with other metals than as a pure metal, and experiments with it as an alloy with iron would, in his opinion, be very valuable.

Mr. Gerhard mentioned that he had had an application for 500 ounces of aluminium at 3s. 9d. per ounce, which he intended to accept.

In answer to an inquiry whether this metal had been precipitated by galvanic action,

Mr. Foster stated that it had, and, moreover, that gold and silver had been precipitated upon it.

Mr. ELLIOTT thought it was no discredit to the present assembly that the discussion of this subject had not been of a more extended character, inasmuch as little was known of this new substance. A great deal of information, however, had been laid before them in the present paper, for which he begged individually to express his thanks to Mr. Foster. He thought it a very wise maxim never to speak upon a subject with which one was not acquainted; and it was a proof of the wisdom of the members present that so little had been said, for the best of all reasons, that but little was known. An example had been set here to-night which he thought all talking public bodies would do well to imitate, namely, never to talk unless they knew something of what they were talking about.

The CHAIRMAN would close this discussion by expressing, on behalf of the meeting, the gratification which they had derived from the paper read by Mr. Foster, and the able manner in which he had treated the subject. He begged to propose a vote of thanks to Mr. Foster for his paper.

The vote of thanks was then passed.

The Secretary announced that on Wednesday evening next, the 9th instant, a Paper by Mr. P. L. Simmonds, "On the Utilisation of Waste Substances," would be read.

THE ECONOMIC MUSEUM.

This collection, which has been formed in the name of the Council of the Society of Arts, by Mr. Thomas Twining, one of its Vice-Presidents, is now open in an advanced state at the Royal Polytechnic Institution. It is intended to form a repertory of useful knowledge for every-day life, so as to show what may be done with limited means and in a comparatively small space, towards realising in a permanent form the scheme of popular instruction and sanitary improvement, which was so successfully carried out in the form of a temporary Exhibition at Paris in 1855, at Brussels in 1856, and subsequently at Vienna and Feldsberg. It is intended to impart to all classes of the community, and more particularly to those whose income is small, that knowledge of common things which is so essential in their every-day life; teaching them what sort of dwellings they should live in to secure health and comfort, what improvements in domestic economy they may derive from the discoveries of science or borrow from the customs and appliances of other nations, what fabrics they should wear, what food they should eat, and how it ought to be cooked; how they may distinguish things which are genuine, wholesome, substantial, durable, and really cheap, from those which are good and cheap only in appearance, and in short, how they may live with judgment, and get the best money's worth for their money.

Arrangements have been made for the delivering of popular and well-illustrated lectures in every branch of the practical philosophy of common life. Minor oral explanations of the articles displayed will be daily given by competent attendants. Moreover, an essential feature of the Economic Museum, is its system of instructional labelling, whereby reference to a catalogue is entirely dispensed with, and the acquisition of useful knowledge made easy to every visitor.

Benevolent persons will find in the Economic Museum an amount of practical information not united elsewhere, for their guidance in the improvement of the dwellings and household comforts of the poor, or in the organisation of provident or charitable institutions. Indeed, the whole of the collection is formed strictly for purposes of social improvement and Christian benevolence, and therefore visitors who may notice deficiencies which they can assist in supplying, or who may otherwise be inclined to co-operate in this undertaking, are earnestly invited to communicate with the curator.

Inventors, manufacturers, and others will be afforded every facility for the display of articles deserving of being recommended to the notice of the public for general adoption.

When fully developed, the Economic Museum will, it is hoped, form a medium for the interchange between Great Britain and the Colonies, and other countries, of inventions, contrivances, publications, and authentic information bearing on the physical and intellectual improvement of the people; and the Museum Library will become a centre for international correspondence on al- matters connected with the well-being of the industrious classes, according to the plan recommended by the Philanthropic Congress held at Brussels in 1856, and of which the realisation is now progressing under the direction of the eminent Belgian philanthropist, M. Ducpetiaux.

The collection is divided into several classes, some of which include building designs, materials for building, furniture, and other household requisites suitable for the working classes, while others embrace clothing, food, medicine, and the means of obtaining light and warmth, as well as various sanitary appliances. Other departments are devoted to the subjects of home education and recreation, while in the Economic Library, which has been added to the Museum, are found various books, pamphlets, and documents (British and foreign) relating to matters of domestic, sanitary, educational, and social economy, and practical benevolence, and especially intended for the use of persons engaged in the organisation of Provident and Charitable Institutions, and of clergymen, medical men, schoolmasters, and others intrusted with the bodily welfare or intellectual guidance of the people.

Programmes of the Museum may be obtained on application to the Secretary of the Society of Arts.

COTTON CULTIVATION IN OUDE.

The following observations on this subject are by Mr. L. E. Runtz Rees, author of the "Personal Narrative of the Siege of Lucknow:"—

"I feel it particularly deserves the attention of those who take an interest in the growth of cotton, to remark how peculiarly Oude is fitted for its cultivation. The best proof of this is that no inconsiderable quantity has been exported from it, even during the mismanagement of the native government, which affected cotton in the same way as, or even more than, the other natural products of Oude. The immense importance of a supply of cotton from India (the only one of our colonies that seems capable of producing it in sufficient quantities) is fully appreciated by our manufacturers, whose very existence as such depends on an independent and regular supply of that article. Its successful growth, we must consider, depends upon both the soil and the irrigation. Both the rich black soil and the more meagre red, which is, in the opinion of many, quite as fitted for the growth of cotton, exist in Oude, particularly in many of the jungles. These, however, might, and should, as I have already pointed out, be made available for purposes of cultivation. Indeed, one firm, Messrs. Burns and Co., I understand, have actually undertaken the contract to clear the Jugdeespore jungle, the fifth in my list. There is sufficient water in the streams and rivers in Oude, which have the further advantage of not being like the Ganges and other rivers, fifty to a hundred feet below the level of the soil; the natives being thus enabled, with even their rude implements, to attend to its cultivation with greater facility than in most other parts in India. But I see no reason why, when European science is brought to bear upon native enterprise, this advantage could not be turned to still further account. European supervision is not so much required for its production as for sugar or indigo. Unlike those, cotton is the raw produce of the tree, and with the increased facilities for transport which must arise, the native would easily be induced to pay sufficient attention to its cultivation to render it equal to any other kind of cotton. The only serious obstacle to the production in sufficient quantities to supply all the demands of our markets is the defective and costly means of transport, nowhere so apparent as in Oude, which not only prevents the native from successfully competing with the American in delivering cheap cotton at a seaport, but also materially damages the quality of the article. The natives of India consume about 2,000,000,000, while the amount exported to all other countries does not exceed 150,000,000 pounds. These figures prove that in India cotton is not grown for exportation, but for home consumption, and that the native agriculturist, possessed of no capital, and loaded with debt, as he is everywhere in India, and oppressed arbitrarily as he has been, particularly in Oude, cannot and will not take the risk of seeking a market elsewhere than on the spot. In some parts of Oude, cotton was produced at even less than an ânna (1½d.) per pound. With steamers on the Gogra, good roads throughout the country, and a railroad through the heart of it, no doubt whatever can be entertained that Oude may be made one of the most important cotton-producing provinces in India; nor is the fact to be questioned that India is capable of furnishing any quantity that may be required."

UNITED SERVICE INSTITUTION.

On Friday, the 28th of January, a memoir was read at the United Service Institution, by Mr. Hyde Clarke, on Indian Military Defence. The object of the paper was to show that in consequence of the adaptation of the healthy hill regions of India to European constitutions (a subject which he had treated in a paper read before the Society of Arts last session*), the military system should henceforth be based on the occupation by English troops and colonization by English settlers of these hill regions, so that India may be held by an English army instead of by a native army, in the tropical cities liable to revolt. Mr. Clarke showed that the Himalayas, the Vindhyas, the Ghauts, Neilgherries, Shevaroys, and attached table lands could support a large body of English settlers with an abundant supply of cheap native labour. He urged the extension of the Madras line to the Neilgherries, of the Northern Bengal Railway to Darjeeling and Assam, and other lines, as an important auxiliary measure. The hill regions, so occupied, would, he pointed out, become a barrier against the aggression of Russia by land, or of France by sea. The approximation of the Chinese frontier to Assam had now become important, as millions of Chinese emigrants might enter from that quarter.

LIFE-BOAT EXPENSES.

During the past year the Royal National Life-boat Institution has incurred the following expenses, on either additional new life-boat stations, or the replacing of old boats, transporting carriages, and houses, by new ones:—Norfolk—Cromer, £276 16s. 5d.; Mundesley, £223 9s. 5d.; Bacton, £377 11s. 11d.; Palling, £272 17s. 6d.; Winterton, £400 5s. 11d.; Yarmouth (two boats), £859 3s. 5d. Suffolk—Lowestoft, £153 14s. 6d.; Southwold, £127 19s. Berwick, £73; Boulmer, £73; Alnmouth, £41; Whitburn, £247 1s.; Hornsea, £44 12s.; Exmouth, £140 1s.; Appledore £44 12s.; Aberdovey, £138 3s. 1d.; Rhyl, £52 17s., Penmon, £72 15s.; Fleetwood, £140 1s.; Fraserburgh £255 2s. 2d.; Lossiemouth, £140 1s. Ireland—Newcastle County Down, £282 7s.; Dundalk, £191 1s.; Kilmore, £140 1s.; Carnsore, £187 8s.; Tranmore, £322 18s. 9d.; Dungarvan, £191 1s.; and Ardmore, £81 11s. 5d. The Institution has also expended on the repairs, stores, alterations, and inspection of its numerous life-boats, boat-houses, and transporting carriages, £2,714 5s. 3d., making altogether a total of £8,265 3s. 9d. It has also granted, during the same period, £952 as awards for saving 427 persons from 64 wrecks on our coasts. This national work has, however, only been accomplished by involving the society in a debt of £3,047, and an expenditure of £1,000 from its small reserved capital. It has now eighty-one life-boats under its management, and to maintain these in a state of thorough efficiency, a large permanent annual income is absolutely needed, if its humane mission is to be perpetuated.

CONVEYANCE OF RAILWAY TRAINS ACROSS THE CHANNEL.

M. Fromage, of Darnetal (Seine Inférieure), proposes to complete the communication between the railways of England and France, by means of very large steamers, capable of conveying a railway train across the Channel. On the arrival of a train at Calais, he proposes that it should be run on to the deck of the steamer, secured, and conveyed across the Channel to a basin in Dover, where he proposes to run the French train on to the English railway, and send it on to London. The return train, on its arrival at Dover from London, he proposes should be run on to the deck of one of those large steamers, secured in its position, and conveyed across the Channel to Calais, where, by means of certain apparatus, it could be landed on the French railway, and conveyed by locomotive power to Paris. He considers this mode of railway communication practicable, easily accomplished at a moderate cost, and far superior to any scheme having for its object the construction of a tunnel under the sea, or a tubular bridge over the Channel.

Home Correspondence.

EXHIBITION OF 1861.

Sir,—Since I addressed you in September last on the question of *site* for the proposed International Exhibition of 1861, and advocated that of Kensington Gore as in all respects the most eligible, the claims of the Crystal Palace at Sydenham have been pressed on public notice. Much has been written on both sides, and until the Council of our Society are in a condition to entertain and decide upon it, much may yet be urged by parties more or less interested in the solution of the question. In the hope that I may be able to direct attention to some serious, not to say fatal objections to the Crystal Palace, which appear to have been overlooked, and to one or two points in favour of Kensington, I once more enter the lists.

It appears to me that to render the proposed Exhibition popular, and therefore self-supporting, if not also profitable in a pecuniary point of view, the following, amongst other minor desiderata, are necessary, so far as site only is concerned.

1st,—It must be easy of access and egress.

Can this be affirmed of the Crystal Palace? The distance from London is alone a formidable impediment, and renders railway or other means of conveyance indispensable, both of which involve time and expense.

Take the first of these—Time. If visitors go by private conveyance, it is not, I think, too much to assume that at least two hours would be consumed, or four hours going and returning. If by rail, the time occupied on ordinary occasions from station to station, including the payment for tickets, is about three-quarters of an hour, or one hour and a half going and returning. But on days of extraordinary attraction, when from 20,000 to 30,000 are seeking conveyance by this channel, I know, from experience that the time lost at London-bridge station is more generally an hour than less. Then, on arrival at the Crystal Palace station, we have a long ascending passage to walk, and nearly 200 steps to climb, before reaching the Exhibition, which consumes time, and is to most people a serious physical impediment. But all this is as nothing compared with the difficulties of egress. Think of thousands of persons on such days, many women and children, crammed together, and on their feet, either in the open garden, or in a long covered avenue, for one or two hours or more, at the close of a fatiguing day, before they can reach the railway platform; and when there to have to encounter the dangerous scramble for seats as empty trains arrive; parents separated from children, husbands from wives, &c., deeming themselves fortunate if they can find space in any carriage and in any company, rather than again encounter the horrors of the "middle passage." On arrival at the metropolitan terminus their troubles are not over; for at the late hour they reach it, cabs, being engaged at the theatres and other places of amusement, are comparatively scarce, and the omnibuses are generally insufficient for the convenience of the multitudes requiring conveyance home. All this is bad enough in fine weather, but when unfavourable from wet, or heat, or both, the aggravation of these annoyances may be better imagined than described.

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* See *Journal*, Vol. VI., p. 323.

If all this applies to the City terminus, what can we say of the new one at Battersea, where, on alighting, the exhausted pleasure-seeker may look in vain for further travelling accommodation, the few cabs venturing to that obscure region being soon snapped up? It may be, however, that before 1861 additional railway facilities to and from the Crystal Palace may be opened up, but this is a possibility on which (assuming all other objections to be overcome, but most of which are absolutely inherent,) it would be dangerous to calculate, for even under the most favourable conditions, the numbers flocking to the Exhibition, taking the facts in that particular of 1851 as criteria, would be more than treble the number of those who visit the Crystal Palace on ordinary occasions, and more than double of those who are gathered there when extra attractions are presented. I believe the greatest number who ever entered it on one day was 37,000,* while at the Great Exhibition the average attendance on the 80 shilling days was 55,493, and on one occasion it reached the almost fabulous number of 109,915. Imagine such a crowd at the Crystal Palace for a single day; if with 30,000 visitors large numbers are detained there until 10 p.m., it would be daylight before these additional victims would be released from their imprisonment.

Take another view of this difficulty. Suppose that 109,915 persons contrived to obtain admission to the Crystal Palace in one day, and that those who must return by rail desire to leave between 3 and 8 p.m., and that a train left the station every five minutes; it would be necessary that each should convey about 2,000 passengers, if, which is a necessary condition, they could take their seats in that small fraction of time. This assumes, also, that passengers are willing to begin returning at the early hour of 3 p.m., when, and long after, many visitors are only arriving. But as in all probability, and, indeed, as at present, few would be disposed to leave before 5 or 6 p.m., the impossibility of all departing before midnight, if then, is sufficiently clear. On the point, then, of access and egress, facts seem to be conclusive against the Crystal Palace.

2nd. The expense, if any, of access to and return from the Exhibition should be inconsiderable.

An Exhibition of manufactures and art, being essentially educational, should be within the means of the many. Can this be said of the Crystal Palace, under the most favourable circumstances? I think not; for supposing any charge to be incurred for conveyance, it must be in addition to that for entrance, to say nothing of the extra time occupied in going so far from London, which to most people is money.

By far the greater number of those who visited the Exhibition of 1851, went and returned on foot, having then only the entrance charge to pay; they were not obliged to start early and leave late. By this double economy of time and money, they could visit it more frequently, and therefore profit more largely by the great lessons it silently taught. Who that was privileged to go often to the great displays of 1851 and 1855, could have failed to witness with interest, on shilling days, the eager anxiety of the humbler classes to understand the mysteries of productive science as developed in working machinery and the vast resources of new or improved engineering and other suitable apparatus, exposed for the first time to minute public scrutiny? To deprive these classes, then, of such extraordinary sources of congenial gratification and improvement, or even to curtail them by unnecessary pecuniary difficulties, would be almost, if not quite, a crime.

Assuming, however, for the moment, the possibility, as has been suggested, of an arrangement by which this portion of the public could be conveyed by rail and admitted to the Crystal Palace at a charge of one shilling, the important element of time remains to be dealt with. As I have already shown, it is an insuperable difficulty, unless, between now and 1861, some extraordinary means of conveyance scarcely less rapid than the electric telegraph should be devised. I have great faith in the as yet undiscovered resources of science, but it has not yet reached this point.

If the Railway and the Crystal Palace Companies are to be paid out of this charge of one shilling, what proportion will remain to defray the cost of erecting a building in Dulwich-wood, as proposed by the directors of the latter, for the reception of paintings and other delicate works of fine art, the re-modelling of the Crystal Palace itself, and its reinstatement when the International Exhibition is over? And what will remain out of the gross receipts, after the discharge of these liabilities, from which to refund the expenses attendant on the preparation and general management of the Exhibition?

I think I may now pretty confidently assume that, in the important items of time and expense, the distance of the Crystal Palace from London takes it out of the second category of desiderata?

3rd. The building should be suitable for the reception, arrangement, and display of the varied and valuable articles which an International Exhibition must contain.

As regards mere extent of surface, it is probable that the Crystal Palace would afford adequate accommodation, but to render it really available, the greater part of its present contents must be removed at a large expense of labour, and at the almost certain destruction of a very considerable portion of the valuable and important collection of imitative ancient, mediæval, and modern art, with which it is now adorned, and which constitutes its best permanent attraction, and when all this is done will it be suitable for the safe display of those delicate and fragile creations of genius, viz. art of all countries, schools, and ages? To say nothing of the almost absolute impossibility of making an enormous glass building impervious to rain, and able to resist such storms as sometimes visit our climate, the great heat in summer would endanger the preservation of oil paintings. I say "endanger," because I know, of course, that pictures are now exhibited in one of the galleries of the Crystal

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* This was on the great "Guides day." I have an impression that on the last "Foresters' day" this number was exceeded, but have not the means at hand of verifying the fact.

Palace, but it is I presume only an experiment thus far, and I am quite sure that the possessors of such treasures of this class, as we are encouraged to expect will be placed at the disposal in 1861 of those who will be responsible for their safe return, will absolutely decline to lend them for exhibition where any—even the remotest—danger of damage should exist. As I have already incidentally observed, the present arrangements of the Crystal Palace as regards exhibiting space, are unsuitable, and would require extensive alterations and additions, the cost of all which when added to the charge to be made for the exclusive tenancy of the building, would go far towards the erection of another, every way convenient, in a more suitable locality.

As a 4th requisite, I might add the importance of a site where the facilities for the reception of goods are easy, safe, and inexpensive, but as much of what I have suggested under the second head is equally applicable to this, it is not necessary that I should further urge it.

Before I quit Sydenham and turn for a moment to the site of Gore-house, which I have always advocated, I have a few words to say respecting the prospects of the Crystal Palace Company, in the event of the offer of the use of their premises, under certain conditions, not being accepted.

Between 1851 and 1861, some 3,000,000 of the population of the United Kingdom, who at the time of the first Exhibition were too young to visit it, will have arrived at an age to appreciate the contents of a new one. Stimulated as they will be by the traditional wonders of that of 1851, by the increased attractions of that of 1861, and assisted by additional railway facilities all over the country, a large proportion of them will probably visit it. Of all these, and of all others who will come to London in that year, it would not be too extravagant to expect that at least one-half would not leave without a visit to Sydenham. As to them the ordinary attractions of the Crystal Palace would be new, and afford ample temptation to spend at least one day there, the directors would be spared the expense of those additional sources of amusement which seem just now to be indispensable. The non-introduction of these novelties will tend to spread the daily visits of strangers more equally over the time the Great Exhibition of 1861 will remain open. This will ameliorate to some extent the difficulties of ingress and egress which now exist, and which I cannot doubt will be still further provided for, to the greatest extent of which it is susceptible.[*]

In 1851, all exhibitions and places of amusement profited largely by the enormous influx of strangers to London. I think, therefore, that taking all these considerations into account, if I were a shareholder in the Crystal Palace Company, I should prefer to decline letting the Palace for the purposes of the ensuing Exhibition, and take my chance of what profit might accrue from the foregoing additional sources.

As between Sydenham and any other locality than Kensington Gore for the Exhibition of 1861, there is now, I believe, no question. And, as the site of the latter has already been advocated by me (see *Journal* for Sept. 17th, 1858, p. 642), and subsequently by abler pens than mine, it is not necessary that I should now remind your readers at any length of the considerations in its favour, especially as the more important of them are tolerably obvious, and may be comprised in a few words.

Kensington, as a suitable locality for the purpose, has been already tested. In 1851, the Exhibition was, as we know, visited altogether by 6,063,986 persons, and, as above mentioned. nearly 110,000 entered and left it without inconvenience in one day. Of this vast number comparatively few availed themselves of carriage conveyance; and for those who resided at too great a distance to walk, or could afford the expense, vehicles in abundance were immediately at hand. It enjoys, then, the prestige of actual experience, and, as a writer in the *Globe* of 22nd Dec., 1858, very truly says, "It is accessible from many leading thoroughfares; it is not far distant from our railways, and if any of the plans for uniting the London and North-Western, the Great Western, and North London Railways with those on the south side of the river, which are already deposited and advertised to be brought before Parliament in the session about to be opened, can be carried out—and some such plan must be carried out—the goods from our great seats of industry might then be delivered at once by means of a short branch line on the grounds of the Exhibition itself without delay, and at a diminished cost."

I shall regret that if in urging the claims of Kensington-gore I may be thought to have depreciated those of Sydenham more than truth and the exigencies of my argument required, and can only say that such was not my wish. It only remains for me to repeat that as the question of site has not yet been before the Council, I only am responsible for the views on that all-important point which I have ventured herein to propound.

I am, &c.,

THOS. WINKWORTH.

Gresham Club, Feb. 1, 1859.

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[*] It is an ascertained fact that, in 1851, 624,000 persons passed through the London-bridge terminus: in 1858, over 13,500,000 passed through it! Assuming additional facilities to be afforded in 1861, this number will, in all probability, be largely increased. And if this is true of one London terminus, what the aggregate increase at all the other metropolitan termini, representing as they do the whole surface of the United Kingdom, and foreign visitors may be, it would be difficult to estimate.

SMALL PARCELS POST.

Sir,—By way of corroboration of Mr. Chadwick's statement that the system of a Small Parcels Post answers perfectly well in Switzerland, allow me to say that it works equally well in Germany and Austria, where it is carried out long since by means of the so-called *Fahrpost*, and a staff of well-equipped postmen. I have not the least doubt that it is greatly owing to that easy and safe means of establishing a literary and commercial intercourse between the members of that odd conglomeration of political bodies, that the curse of a centralization of intellectual and manufacturing power has as yet been withheld from that country, and a sound and unsophisticated mode of thinking and action been made the best compensation for the want of other more shining advantages.

I am, &c.,

A. TOLHAUSEN.

London, 31st January, 1859.

ELECTRO-ZINC DEPOSITS ON ENGRAVED COPPER-PLATES.

Sir,—M. Louis Figuier, of Paris, through the instrumentality of my friend and *confrère* M. Henri Plon, the eminent printer and publisher of Paris, having recently, in the columns of *La Presse* newspaper, made mention of my mode of surfacing engraved copper plates with a coating of pure zinc by electro-metallurgical means, for the purpose of protecting such plates from wear while printing, and which coating can be removed and renewed at pleasure with facility and without injury to the engraved plate, I beg leave to introduce the particulars of my mode, for the benefit of those interested in extending the application of the galvano-plastic art.

To obtain a deposit of pure zinc capable of printing from 1,500 to 2,000 impressions or more, before requiring to be removed and renewed, I have recourse to a combined solution of chloride and cyanide of zinc, prepared as follows:—

Chloride of Zinc Solution.—In a suitable vessel dissolve one part chloride of ammonium in eight parts water; place in this a porous cell containing the same solution and a copper plate, which attach to the zinc of a Smee's battery, and in the outer cell place a plate of spelter, which attach to the silver of the above battery for 48 hours.

Cyanide of Zinc Solution.—Dissolve ½lb. of cyanide of potassium in twelve parts of water; then add as much chloride of zinc as the solution will take up.

Mix these solutions together in equal parts; use a zinc positive pole and one of Smee's compound batteries, intensity arrangement, charged with one part of sulphuric acid to twelve of water.

In from 45 minutes to an hour a deposit of the most beautiful lustre will be obtained, capable of yielding from 1,500 to 2,000 impressions, and even more, according to the experience of the manipulator.

I am, &c.,
HENRY BRADBURY.

Whitefriars, Feb. 3, 1859.

Proceedings of Institutions.

Croydon Literary and Scientific Institution.—In the report presented at the Annual Meeting held on Thursday, December the 9th, 1858, the Rev. J. G. Hodgson, M.A., President, in the chair, the Committee speak of the continued usefulness, as well as greater public appreciation of the Institution. The Members' List shews a considerable increase, whilst the account of income and expenditure shews an available balance. This is the second time only, in the history of the Institution, that such a financial position has been reached, and this in spite of the finances having been considerably tried by the outlay for furniture, fittings, and repairs incidental to the removal to a more commodious habitation. The total income from all sources (including a balance from last year of £46 1s. 11d.) amounted to £383 15s. 3d. the expenditure being £354 6s. 5½d., leaving a balance in favour of the Institution of £28 12s. 6½d. The average number of members was 505 against 438 of last year. During the past year 161 volumes have been added to the Library, half of them being purchased, bringing the number up to 4,663. The lectures which have been delivered during the past year have been of a varied and attractive character, and the attendance has been highly satisfactory. The following is a list of them:—Dr. G. Kinkel, "Early Christian and Byzantine Art;" Mr. G. Buckland, Musical Entertainment, "Songs of Dibdin and other Composers;" Mr. J. K. Applebee, on "Thomas Hood;" Mr. A. Francis, Dramatic Declamation from "Virginius;" Rev. C. Boutell, "National Flags of England;" Dr. Daniel, "Sir Walter Raleigh;" Dr. Daniel, "James Stuart the First;" Mr. D. W. King, Musical Entertaiment, "Up the Thames;" Mr. Geo. Grossmith, "Wit and Humour;" Mr. G. Barker, Musical Entertainment, "Moore's Melodies and Shakespere's Songs;" Dr. Daniel, "Charles Stuart the First;" Dr. Daniel, "Charles Stuart the Second;" Mr. J. E. Carpenter, Musical Entertainment; Dr. Daniel, "James Stuart the Second; Mr. B. Wells, "Lecture on the Flute;" Mrs. C. L. Balfour, "Charlotte Bronte;" Mr. H. Phillips, Entertainment, "Voyage through Life." The following were delivered gratuitously by gentlemen of the town and neighbourhood, to whom the Committee feel that a great debt of gratitude is owing, viz:—Col. Rowlandson, "The British Rule in India;" Rev. J. Steer, "George Stephenson;" Dr. Knighton, "Calcutta;" S. C. Hall, Esq., "Fairy Legends of Ireland;" Rev. G. Capel, "Numerical Notation;" J. H. Stocqueler, Esq., "Pleasures, Advantages, and Experiences of Foreign Travel;" D. Puseley, Esq., "Literary Entertainment;" Rev. W. Mitchell, "The Atlantic Telegraph;" Rev. J. White, "Science in a Drop of Water;" Rev. W. H. Johnstone, "The Materials and Construction of the Bible." The Committee are of opinion that these lectures have done more real service to the Institution than any received from paid lecturers, and they feel great satisfaction in stating that the list of gratuitous lecturers will be as extensive during the ensuing year. The Committee are promoting the establishment of a Company, under the Limited Liability Act, for the purpose of erecting a suitable Hall, and they state that a large number of shares have already been suscribed for. A list of donations for the same object has also been opened, and a considerable sum received. The formation of classes has not yet been fully carried out, but it is satisfactory to find that two have sprung into existence, viz., first, an Elocution and Discussion Class, which meets weekly, under the management of Mr. C. Messent, and, by urging the young men members to a careful reading of the subject to be discussed, is working some good; and second, a Music Class, held at the Town Hall, under the superintendence of Mr. J. T. Budd. The Committee wish to form classes for any subject that the members may require of an educational character, provided they are able to obtain proper superintendence.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
London Inst., 7. Prof. Huxley, "On Biology."
Entomological, 8.
British Architects, 8. Mr. F. C. Penrose, "On Various Matters connected with St. Paul's Cathedral."
Medical, 8.
Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Syro-Egyptian, 7½. Rev. B. H. Cowper, "On the Syrian Language and Literature."
Civil Engineers, 8. Mr. James W. Jameson, "On the Performances of the screw steam-ship *Sahel*, fitted up with Du Tremblay's combined vapour engine, and of the sister ship *Oasis*, with steam engines worked expansively, and provided with partial surface condensation."
Medical and Chirurg., 8½.
Zoological, 9.
Wed. ......Literary Fund, 3.
London Inst., 3. Mr. E. W. Brayley, "On Meteorology."
Society of Arts, 8. Mr. P. L. Simmonds, "On the Utilisation of Waste Substances."
Graphic, 8.
Archæological Assoc., 8½.
Thurs. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Royal Soc. Club, 6.
London Inst., 7. Mr. G. MacDonald, "On the Poetry of the 16th Century."
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri..........United Service Inst., 3. Mr. W. H. Flower, "On the importance of a knowledge of the Elements of Practical Surgery to Naval and Military Officers."
Astronomical, 8.
Royal Inst., 8½. Mr. E. Beckett Denison, "On some of the Grounds of Dissatisfaction with Modern Gothic Architecture."
Sat. ......Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, January* 28, 1859.]

Dated 10*th December*, 1858.

2832. J. Bethell, 8, Parliament-street—Imp. in machinery and apparatus for the preservation and colouring of wood.

Dated 31*st December*, 1858.

3004. J. H. Sievers, 48, Rathbone-place, Oxford-street—Apparatus for tightening and releasing the belly bands of riding saddles. (A com.)

Dated 3*rd January*, 1859.

28. E. Balchin, Myton-gate, Hull—An improved construction of projectile, applicable to the whale fishery.

Dated 7*th January*, 1859.

52. I. Holden, St. Denis, near Paris, and A. Holden, Bradford, Yorkshire—Imp. in means or apparatus employed in preparing and combing wool and other fibres.

54. J. J. Florance, Paris—Imp. in reels or spooling-wheels.
56. A. Barclay, Kilmarnock, N.B.—Imp. in electric and magnetic telegraphs.
58. H. Reynolds, Denmark-hill, Surrey—Imp. in refining and decolorizing saccharine substances.

Dated 8th January, 1859.

60. H. Harden, Dundalk, Ireland—Imp. in fire bars for steam boiler and other furnaces.
62. D. Friedlander, Manchester—An improved smoking pipe.
64. F. Versmann and A. Oppenheim, Bury-court, St. Mary Axe—Imp. in the treatment of various substances, by which to render the same uninflammable.

Dated 10th January, 1859.

72. R. D. Clegg, Manchester—Imp. in signalling apparatus.
74. T. J. Claxton, Montreal, Canada—Imp. in the manufacture of boots and shoes. (A com.)
76. J. S. Margetson, Cheapside—An improved box or case, suitable for hats, collars, and other useful purposes.

Dated 11th January, 1859.

80. C. M. Kernot, Gloucester-house, West Cowes, Isle of Wight—Imp. in purifying and decolorising paraffine, and rendering the same white, hard, and sweet.
82. B. Robbin, Yarmouth, Nova Scotia—Imp. in the machinery for working pumps.
84. D. E. Hughes, Northampton-square—An improved mode of insulating electrical conducting wires.
86. R. Hawthorn and W. Hawthorn, Newcastle-upon-Tyne—Imp. in apparatus for promoting combustion and preventing smoke in coal-burning locomotives and other steam-boiler furnaces.
88. F. Versmann and A. Oppenheim, Bury-court, St. Mary Axe—Imp. in rendering fabrics and substances non-inflammable.

Dated 12th January, 1859.

90. P. Bouché, 57, Rue de Bretagne, Paris—Imp. in the used means for mechanically raising up the gowns of ladies and young ladies.
91. W. Bray and W. T. G. Bray, Folkestone—Imp. in locomotive and traction engines.
92. W. Oliver, Shadwell—Imp. in boats, and in the mode of propelling them.
93. J. Thomson, Dundee—Imp. in the manufacture of rugs.
94. J. Hands, Elgin-crescent, Notting-hill—Imp. in preserving or preparing skins intended to be converted into leather, or otherwise manufactured.
95. J. Gibbons, 345, Oxford-street—Imp. in fixing door and other knobs.
96. S. Canning and H. Clifford, Leadenhall-street—Imp. in machinery for paying out and for recovering or picking up submarine telegraph ropes, cables, or chains.
97. T. Elwell, Paris—Imp. in governors for steam engines and other motive power engines.
98. W. McNaught, Manchester, and W. McNaught, Rochdale—Imp. in steam engines and in apparatus connected therewith.
99. S. Phillips, Moseley, Worcestershire—Imp. in fastenings for securing windows, shutters, and doors, and for other similar uses.
100. R. Mushet, Coleford, Gloucestershire—A new or improved metallic alloy.
101. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.
102. C. N. May, Devizes, Wiltshire—Imp. in sluice valves.
103. C. Beslay, 52, Rue St. Sebastien, Paris—Imp. in coating or covering iron or steel with tin, zinc, or lead, or alloys of those metals, by electrical deposit.

Dated 13th January, 1859.

104. C. N. May, Devizes, Wiltshire—An improved heat indicator.
105. R. A. Lightoller, Chorley, Lancashire—Certain imp. in machinery or apparatus for spinning cotton or other fibrous materials.
107. W. H. Crispin, Marsh-gate-lane, Stratford—Imp. in the construction of ships and other sailing and steam vessels.
108. H. Critchley and S. Elston, Bury, Lancashire—Certain imp. in pistons for steam engines or other purposes.
109. G. Scopes, Needham Market, Suffolk—Imp. in apparatus for communicating motion to cots, cradles, and other articles for children's use.
110. J. Picksley and R. Sims, Bedford Foundry, Leigh, Lancashire—Imp. in lawn mowing machines.
111. W. H. Morrison, Nottingham—Imp. in wind musical instruments.
112. D. L. Banks, Kennington, Surrey—A method of constructing a travelling suspension rail or roadway, applicable, among other uses, as a bridge and lifting agent.
113. J. J. Stevens, Darlington Works, Southwark—Imp. in railway signal apparatuses.
114. F. J. Manceau and E. N. Vieillard, Paris—Imp. in breech-loading fire-arms and in cartridges.
115. J. Grist, Beazley-crescent, Old Ford, Middlesex—Imp. in machinery for cutting and shaping staves and heads for casks, and for the manufacture of casks.
116. W. A. Chadwick, Wandsworth-road—A musical instrument, chiefly for teaching the intervals of musical scales.
118. T. Herbert and E. Whitaker, Nottingham—Imp. in the manufacture of warp lace.
119. O. Rowland, 4, Chapel-street West, May-fair—Imp. in laying electric telegraph wires in streets.
120. J. Barrans, 2, Caledonian-terrace, Queen's-road, Peckham—Imp. in traction and portable steam engines.
121. T. Sampson, Calle Cartanos, 8, Barcelona, Spain—Imp. in apparatus for feeding steam boilers with water.

Dated 14th January, 1859.

122. S. Holt, Manchester—A new and improved manufacture of woven silk fabrics.
124. William Craft, 12, Cambridge-road, Hammersmith, and T. Wilson, Bradmore-house, Chiswick—Imp. in drawers and napkins so as to render the same waterproof.
125. W. Davis, 2, Ann-street, Globe-fields, Mile-end—Imp. in sluice valves.
126. J. Dauglish, M.D., Tunbridge Wells—Imp. in obtaining carbonic acid gas.
127. R. Romaine, Chapel-street, Bedford-row—An improved arrangement of portable railway.

Dated 15th January, 1859.

129. W. H. E. McKnight, Lydiard-house, near Swindon, Wiltshire—An upright-celled boiler applicable to all heating purposes by hot water or other fluid.
131. D. L. Banks, 3, Kennington-row, Kennington-park—Imp. in the method of constructing a travelling suspension rail or roadway, to be used for the cultivation of land.
133. W. Betts, Wharf-road, City-road—Imp. in the manufacture of capsules, and in the apparatus employed therein.

Dated 17th January, 1859.

135. W. Morgan, 31, Grafton-street, Fitzroy-square—Imp. in printing and stencilling, and in the apparatus or machinery used therein, also for certain applications of such printing and stencilling.
137. J. Montgomery, New York, U.S.—Imp. in the construction of the hulls of steam and other vessels, and in the feed-water heaters, boilers, water-gauges, condensers, engines, and propelling machinery appertaining to the former, a portion of which improvements, with the exception of those on the hull, are applicable to analogous useful purposes.
139. P. A. de S. S. Sicard, Paris—An improved process and apparatus for converting cast iron into steel.
141. W. E. Newton, 65, Chancery-lane—An imp. in sewing machines. (A com.)
143. R. G. Salter, Alphington, Devonshire—Imp. in apparatuses for collecting or picking up letters, papers, and other articles requiring to be stamped or printed.
145. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of cast steel.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Jan.* 28, 1859.]

January 28th.

1714. J. Brierley.
1716. J. F. W. Featherstonhaugh and F. Wise.
1722. J. Watkins.
1723. C. Schiele and F. Schiele.
1725. T. Webb and J. Craig.
1726. J. Davey, H. Sims, J. Mayne, W. Hodge, and J. Gerrans.
1729. J. S. Bailey.
1733. G. Ashcroft and H. W. Wood.
1734. G. Davies.
1736. H. Conybeare.
1737. H. Conybeare.
1750. J. L. Norton.
1758. R. Cunningham.
1760. G. Bell.
1763. J. Greenwood.
1768. J. Taylor.
1776. J. Luis.
1859. A. Slate.
1946. W. E. Newton.
1950. Jonathan Ireland.
1978. A. V. Newton.
2046. J. Wright, sen., and J. Wright, jun.
2156. C. Hall.
2310. T. W. G. Treeby.
2317. B. Nickels.
2399. J. W. Mott.
2452. H. Tertian-Moret.
2498. W. Smith.
2606. J. M. Miller and J. Fear.
2652. E. H. Bentall.
2660. A. V. Newton.
2698. R. Alexander.
2721. J. Gresham.
2754. L. Mac Kirdy.
2755. L. Mac Kirdy.
2767. C. Coates.

[*From Gazette, Feb.* 1, 1859.]

February 1st.

1744. J. W. Schlesinger.
1747. S. Hine.
1766. C. Callebaut.
1779. J. Luis.
1785. R. A. Brooman.
1794. S. Carey.
1795. G. Weston.
1820. R. H. Collyer, M.D.
1837. J. Fogg.
1893. F. Preston & W. McGregor.
1924. J. Macintosh.
2037. A. McEwan Peters.
2373. W. E. Newton.
2416. W. E. Newton.
2651. A. V. Newton.
2775. R. Pickering.
2821. H. Maudslay.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, January* 28, 1859.]

January 24th.

222. J. Wormald.
254. J. L. Stevens.

January 25th.

236. D. Foxwell.

January 26th.

269. T. Hurst.

[*From Gazette, Feb.* 1, 1858.]

January 27th.

299. E. S. Robinson.

January 28th.

255. J. Gretton.
261. H. Tylor.
268. J. B. Anderson.
287. B. F. Miller.
318. J. Howard.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 11, 1859.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement :—

For Ashbourne.

Rev. W. A. Duckworth.
Rev. J. R. Errington, Vicar of Ashburne, President of the Institution.
Rev. J. L. Errington.
Mr. Francis, 1st Class Certificated Master.
Dr. John Lee.
Rev. T. J. Jones.
Mr. C. J. Welch, Solicitor.
Captain Holland, R.N., *Secretary.*

For Glasgow.

Dr. Thomas Anderson, Professor of Chemistry, Glasgow University.
Mr. Hugh Blackburn, M.A., Professor of Mathematics, Glasgow University.
Mr. James Bryce, M.A., F.G.S., High School, Glasgow.
Rev. James Taylor, D.D., Oakfield House, Hillhead, Glasgow.
Dr. Allen Thomson, Professor of Anatomy, Glasgow University.
Mr. James Young, Sardinia-terrace, Glasgow.
Mr. Charles Wingate, Accountant, Mechanics' Institution, 57, North Hanover-street, Glasgow, *Secretary.*

For Leicester.—Church of England Institute.

Rev. A. Hill.
Rev. W. Hill.
Rev. T. Jones.
Mr. Thomas Ingram.
Mr. Richard Luck.
Rev. W. B. Moore.
Rev. E. T. Vaughan.
Rev. J. O. Picton, *Secretary.*

ENGLISH ART IN FRANCE.

The following letter has been addressed by Mr. John P. Knight, Secretary of the Royal Academy, to M. Théophile Silvestre :—

Royal Academy of Arts, Trafalgar Square,
London, 31st January, 1859.

Sir,—I laid your two letters, the last dated the 24th inst., before the President and Council of the Royal Academy of Arts, at their meeting on Saturday last, and am directed to convey to you the assurance of their high appreciation of the expression of H. E. the French Minister of State, in approbation of the English school of art, and also of the offer on his part to devote a room for the reception of English works of art for exhibition at the Palais de l'Industrie in April next. I have also received instructions to make known this gratifying and generous offer to the president of the different Art Societies in Great Britain.

The President and Council feel that this expression of sympathy for British Art, on the part of the French Government, deserves and demands an earnest response from British artists, as founding a noble emulation and mutual good-will between the artists of the two countries.

I have the honour to be, Sir,
Your obedient servant,
JOHN P. KNIGHT, R.A., Sec

TENTH ORDINARY MEETING.

Wednesday, Feb. 9, 1859.

The Tenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 9th inst., William Hawes, Esq., Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Green, Richard Angell
Hixon, John
Laing, Rev. David, M.A.
McKinlay, W. Boyd, M.D.
Peel, George, C.E.
Simkin, Richard
Williams, James

The following Institutions have been taken into Union since the last announcement :—

Gosport and Alverstoke, Literary and Scientific Institution.
Ashbourne, Working Men's Institute.
Widnes Dock (near Warrington), Mechanics' Institution.

The Paper read was—

ON THE UTILIZATION OF WASTE SUBSTANCES.

By Peter Lund Simmonds.

The announced title of the paper I am about to read scarcely expresses accurately the subject I propose to discuss, but it would be difficult to find one which should embrace and define all the matters to be treated of. There are many substances already utilized, which are to all intents and purposes waste or refuse substances; and there are very many others not used, which are also waste substances, and well worthy of the attention of practical men. The subject is highly important in its commercial bearings, whether the substances utilized are limited or extensive, because they all lead to a watchfulness and thriftiness which converts waste matter to some profitable use.

Viewed in its collective form, it has not occupied that prominent degree of attention which it demands; and although I cannot hope to bring forward much that is new, yet the hints and details respecting some of these reconversions and applications of waste materials may lead to thought, and prove profitable in other quarters, while they will probably elicit in the subsequent discussion much interesting information on these and other substances.

When we perceive in nature how nothing is wasted, but that every substance is reconverted, and again made to do duty in a changed and beautified form, we have at least an example to stimulate us in economically applying the waste materials we make, or that lie around us, ready to be utilized.

Some subjects of this kind have already occupied the special attention of the Society, and among others I may allude to those of fish-guano by Mr. Horace Green and Mr. Lawes (*Journal*, Vol. ii., p. 87); the Utilization of the Sewage of Towns, by Mr. Fothergill Cooke (Vol. v., p. 49); "The utilization of the slags or molten mineral products of smelting furnaces," by Dr. W. H. Smith (Vol. iii., p. 335) &c.

In every manufacturing process there is more or less waste of the raw material, which it is the province of others following after the original manufacturer to collect and utilize. This is done now to some extent, more or less, in almost every manufacture, but especially in the principal ones of the country—cotton, wool, silk, leather, and iron. But new industries spring up from time to time, and out of the waste of these, much commercial wealth has yet to be drawn.

In the desultory observations I am about to offer, I shall group the waste substances, for convenience, under the ordinary divisions of Animal, Vegetable, and Mineral.

First then, as to the Animal Products:—

In the woollen manufacture a considerable portion of the raw material is scattered as waste; but there are a number of "waste merchants" in different parts of the country who buy up everything like wool, and send it to Leeds, Dewsbury, and Batley, to be made into shoddy or mungo. Being mixed with some new wool, it is spun into yarn, and made into broadcloth, doeskins, pilot cloths, druggets, and coarse carpeting. The reproduction of a woven fabric from material formerly regarded as entirely waste and useless for such purposes, is a striking illustration of the adaptive ingenuity of the present day.

Besides the woollen rags collected at home, others are imported. These are torn up by machinery, and their fibrous material entirely separated; this is then spun into "low numbers," and made into a coarse description of woollen cloth, used for baize, table-covers, &c.

The rag-grinder takes the cloth, when thrown aside by the wearer, cuts it into particles, which he forcibly tears asunder, and thus re-models them into raw material, to be again used by the first consumer. And of such consequence is this last process to the trade, that the 16 rag machines in the town of Leeds alone are capable, in full work, of producing 3,605,760 lbs. of raw material in a year, or (upon the average of 9lbs. to the fleece,) of adding to the annual stock of wool the fleeces of 400,000 sheep.

A recent visitor to the woollen districts of Yorkshire has discovered that pilot cloth is shoddy; that glossy beavers and silky-looking mohairs are shoddy; that the Petershams so largely exported to the United States are shoddy; that the soft, delicate cloths in which ladies feel so comfortable, and look so graceful, are shoddy; that the "fabric" of Talmas, Raglans, and paletots, and of other garments in which fine gentlemen go to the Derby, or to the Royal Academy Exhibition, or to the evening services in St. Paul's and Westminster Abbey, are shoddy. And if Germany sends us abundance of rags, we send to Germany enormous quantities of shoddy in return. The best quality manufactured at Batley is worth ten shillings a yard; the commonest not more than one shilling.

Even the greasy cotton wads with which engineers wipe their machinery enter into the material of some qualities of shoddy. But there are woollen rags that are not good enough for shoddy, and these are used as manure for the hops in Kent, so we get shoddy in our beer as well as in our broadcloth. Two-and-a-half lbs. of dry woollen rags, we are told, are equal to 100 lbs. of farm-yard manure, or 15 lbs. of liquid blood, when applied to land.

In addition to the rags and tailors' clippings, worsted stockings, carpeting, skirtings, and such like, are pulled to pieces and reworked.

The flocks made at the "rusing gig" from pilot cloth in the wet state, are cleaned and dyed, and used in the manufacture of certain yarns. These flocks are also used for stuffing mattrasses, seamen's bedding, and common articles of furniture. There is still, however, some "mill waste" which cannot be worked up again for shoddy, namely, that portion of the wool waste which is so saturated with oil and grease, that the fatty matter is heavier than the wool. This is called "creash," and forms a very valuable manure.

A process is now in operation at the Kinghole woollen mills, near Dumfries, by which the hitherto refuse water of the washing houses is converted into valuable commercial material. By means of mechanical appliances and chemical action, the refuse formerly turned into the river Nith to the injury of the salmon, is made to produce stearine, which forms the basis of composite candles, as well as a cake manure that sells at 40s. per ton.

Teal's patent for recovering the fat from waste soap liquors is chiefly applicable to wool-scourers' soap-waste, and is conducted in the following manner:—

The fluid, as obtained from the wool-scourers, is run into large tanks, where it is treated with sulphuric acid, which causes the fat to separate from the soap and rise to the surface, carrying with it all the impurities removed from the wool. The semi-solid product, after separation from the water, is, according to Professor Anderson, subjected to pressure in powerful Bramah presses, when the oil or grease is expressed; and a dark brown cake, still containing some oil, along with small quantities of woollen fibre and other impurities, is left.

This refuse substance, which contains about 71 per cent. of organic matter and 3 per cent. of alkaline salts, is sold for manure. Glue-makers' refuse has long been employed as a fertilizer in the vicinity of tan and glue works, and with good success when applied to any kind of crop, as from its putridity it acts rapidly. It is worth about 36s. per ton.

Poake, a name among fellmongers for the collected waste arising in the preparation of skins, which consists of lime, oil, and hair, in various proportions, is also bought for manure.

Wool, ground very fine and dyed, is now extensively used in the manufacture of flock-paper hangings. The wool that comes off the sheep-skins, after soaking in the lime-water of the tan-pits, is sold, when washed, at 3d. to 5d. the pound. We import 2,340 tons of woollen rags annually, valued at £21,658; and flock for paper-stainers to the extent of 1,350 cwts., of the further value of £5,400.

In the carpet manufactories, the waste from the carpet looms is used for stuffing mattresses, &c.; another portion of the waste from the looms and winder-wheels is used for making prussiate of potash, and the general mill-waste for manure.

There are many light articles of ladies' dress, such as balzarines, orleans, coburgs, alpacas, &c., which are formed by an admixture of a warp of cotton with a weft of worsted, or of mohair, alpaca, &c. Now, after these are worn out or thrown aside, they are comparatively valueless, from the mixture of the two substances, but, by a chemical process, the cotton is now destroyed, and the wool, the most valuable substance of the two, is recovered for future use in making woollen cloth. I have here specimens of dresses first, as collected from the dust-hole; secondly, after boiling in acid; thirdly, the recovered wool teazed into Bromley wool, the refuse dust being used as manure; and, finally, cloth made of one-fifth long wool and four-fifths of this Bromley wool.

Cow-hair, from the tanneries, is used for mortar and for making felt; but, in some parts of the continent, they make ropes and carpets of it, and stuff sofas and chair-cushions with it instead of with horsehair.

The waste shavings in whalebone cutting are employed as a stuffing material by upholsterers, and for filling firegrates in summer; and all the refuse goes to the farmer for manure, or to the prussiate maker, to be used with other animal substances, woollen waste, rags, hoofs and horns, button-makers' refuse, bone drillings and filings, to form those beautiful salts.

We import yearly about 21,000 cwts. of raw knubs and husks of silk; the husk which covers the chrysalis, after the best silk is reeled, is used for bed covers, or spun for common silk stuffs. This offal amounts to 10 per cent of the weight of raw silk. The gum has to be discharged from the husks and knubs; these are bleached and the dressed waste cut to a uniform length for carding. It has then to be twisted into skeins, rovings, and cops. The Chinese, not content with using the silk thread of the cocoon, with their usual thriftiness, determining that nothing shall be wasted, eat up the chrysalis itself.

Under the various names of glue pieces, sizing, spetches, and scrows, the offal or parings of skins and hides and the pelt from furriers, the hoofs and ears of horses, cattle, and sheep, are used by the glue makers. Old leather scraps are even converted into glue. Gelatine is a purer kind of glue, also obtained from waste materials, such as the raspings and trimmings of ivory, the bones, cartilage, and tendons of animals. The clippings of parchment, vellum, gloves, leather, and other kinds of skin and membranes yield size. The French buy up largely our written parchments, and after removing the writing, return them to us in the shape of kid gloves. The shavings of seal and other skins are used for filling tennis and cricket balls.

Dog-fish are caught principally for the oil obtained from their livers, a large fish yielding about a barrel of oil. Their dried bodies are sold in Nova Scotia at 2s. 6d. the hundred, for feeding pigs during the winter, from November till May; two fish boiled or roasted are given per day to a good-sized store pig.

Several hundred dog-fish skins are anually imported, principally for smoothing wood and metals by their rough abrading surface. Eel skins are used in America and other quarters for twisting into ropes and whip lashes, and to form the thongs connecting the swiple and hand-staff of the thrashing-flail. Sole skins, and some other fish skins, are sold in large quantities to dealers at 4½d. a ℔, being used to refine liquors, clear coffee, &c.

Porpoise skins are now tanned, and make excellent shoe leather. The walrus hide has also been used for a similar purpose. In Texas, they even tan and prepare alligators' skins, so as to resemble the finest calf-skin in pliability, and they are beautifully mottled, like tortoise shell. Boots have been made of them, and it is certainly something novel to change the skins of these huge ugly reptiles into forms of beauty and usefulness. We hope also to get musk from them some day. In the East and in Africa, they convert snake skins into slippers, and use them as we do shagreen, for giving a firm grip of the hand to the sword hilt. The women of the Orotchys, Tungooses, and Goldians, have the art of tanning or preparing the skin of some species of salmon, so as to be flexible, for the purposes of clothing, and it forms most of their dress.

We have long paid a tax on dogs in this country, but in Paris the imposition is new, and it led to an immense destruction of these quadrupeds in the Seine. A number of persons forthwith engaged in the occupation of getting out the dead bodies, and boiling them down to extract the fat, which is employed in the preparation of kid gloves, and especially of straw coloured ones, being sold at the rate of 2½ francs per kilogramme.

In New York, from 5,000 to 8,000 stray dogs are annually impounded, and those not redeemed are drowned. The carcases are taken to the offal boats, which convey them to Barren Island, where every part of them is turned to some useful account. The fat is melted out; the skins are sold to glovers; and of the bones an excellent compost for fertilising land is made.

Dogs' fat is very much used by the Germans in the United States, the Cape, and other localities, in cases where cod liver oil would be prescribed by our physicians.

Whether the dog is utilized to the same extent here I am not prepared to say, but we see a good many dog-skin gloves ticketed in the outfitters' windows, and as there are more than 400,000 dogs on which duty is paid, exclusive of fully as many thousand more in the country which do not pay the tax, there is scope enough for industry in this respect.

Bones are certainly a waste product, and are largely used for various purposes. Even the shank bones of the giraffe have recently been imported in some quantity from Southern Africa. Ground bones, and dissolved bones, or superphosphate of lime, are in extensive demand as fertilisers, and superphosphate is also manufactured from coprolites. It is the meanest of the bones that are ground up for phosphates, and made fertilizers of the soil. Bones enter largely into commerce for manufacturing purposes, being employed by cutters, turners, and others, for making bone black or animal charcoal. They are converted into handles for tooth-brushes, nail-brushes, knives, fans, combs, small spoons, buttons, and a score of other things. Bones are classed according to their value. Thus, the thigh bones of bullocks are the most valuable. The jaw-bones come next, and the short bones, the refuse of the family table, are of the least importance.

Bones are boiled to obtain the gelatine and for the size used by dyers and finishers of fustians, velveteens, &c., and to obtain the fat, which is white from fresh butchers' bones, and brown from imported and old collected bones. The colour is improved by this boiling. The bone waste, dust and refuse is extensively used for manure.

We imported about 64,000 tons of bones in 1857, valued at £397,000; and it is estimated that 70,000 tons are collected at home, worth about £435,000 more.

Mr. Geo. Torr, one of the largest manufacturers of animal charcoal, &c., in the metropolis, could supply much valuable information on this head.

How seldom is any attempt made to save the blood when animals are slaughtered on the farm or by village butchers; in large cities and towns blood is very generally collected and sold to refiners of sugar and other classes of manufacturers. It is made into animal charcoal and albumen. Coagulated, it is sold to calico printers for dyeing Turkey red, and in some of the agricultural districts it is esteemed as a fertiliser.

Some people use the blood of cattle largely as food, mixed with meal of one kind or another. When intended for this purpose it is stirred briskly as it flows from the veins, whereby its coagulation is prevented, and it is then stirred into the meal, and boiled or cooked in any other way. The coagulating property of blood renders it of considerable use in clarifying thick mucilaginous liquors. Mr. T. Dixon, one of our members, has supplied me with specimens of the of the residue after being used in refining sugar, which is sold as manure.

Cider is sometimes fined by this method, being simply beat up cold with the blood and put into a barrel. On standing a day, the entire coagulation of the blood, with the impurities of the cider, are found lying at the bottom, in a tough cake, and the liquor above is quite transparent and nearly colourless.

Bile, the bitter principle secreted by the liver, has been occasionally employed with advantage in medicine, when dissolved in alcohol or inspissated. But its chief use out of the body is as a detergent to scour wool and cloth, remove grease-spots, &c. Ox-gall is chiefly applied to this purpose. It here seems to act as a kind of soap, but with superior powers as a detergent than the mere quantity of alkali in it would indicate.

The same property of mixing with and dissolving oily matters renders bile useful to painters in various ways. When refined it is used by artists to fix chalk and pencil drawings before tinting them. Ivory, when rubbed with ox-gall, loses its greasy gloss, and is thereby much fitter to receive colours, and the gall itself is used to mix greens, bistre, and some colours where the greenish yellow of the gall is not perceived.

The very pretty and durable ornaments now made from fish-scales, by Mr. S. Mahood, are a new and attractive application of a waste substance; fish-scale tiaras, brooches, bracelets, &c., are well known, and to be met with in the galleries of the Crystal Palace, the bazaars, and other places. Fishes' eyes are also utilized by the manufacturer of shell flowers for making the undeveloped buds.

The natives of the north-west coast of America make from the entrails of fishes, bracelets, fishing lines, thread, work-bags, head-dresses, and needle-cases; of the bones they also form fish-hooks and needles. But our more civilised brethren on the other side of the Atlantic have turned fish-bones to another purpose; they boil, cleanse, and shred them, and pass them off as isinglass, with scarcely a particle of the gelatinous property. I am surprised to find this rubbish now filling the windows of dealers who claim to be respectable, as I called attention to this substance some years ago in this room, after Mr. Archer's paper.

When we get valuable dyes from cochineal, lac, and kermes, when we can obtain formic acid from ants, and raise blisters by cantharides, there is no reason why we should not attempt to utilise other insects. In a recent number of an Australian paper I find the following paragraph. Whether it be in joke or earnest I cannot say, but if the discovery be a fact, I should, by all means, recommend the collection of the raw material in this great metropolis:—

"A late arrival in Melbourne is engaged in rather a novel occupation, being no other than extracting a dye from those nocturnal depredators unfortunately remarkably prevalent in this colony—bugs! We have seen the dye, which very much resembles that which is extracted from the cochineal insect. Our spirited "new chum" has a wide and luxuriant field for his peculiar operations in Australia, and will richly deserve the thanks of every man, woman, and child in the community, if he vigorously pursues his manufacture till he has utterly exhausted the raw material. Who knows but this happy idea of making the insects "dye" may in a few years render a bug as rare a curiosity in an Australian museum as a tinder-box, flint, and steel."—*Melbourne Argus.*

The paunches and butchers' offal, liver, boiled horse-flesh, &c., are sold as food for dogs and cats. Wholesale horse-flesh costs the dealers 1¾d. to 2d. per pound; we cannot, therefore, wonder that the cat's-meat vendors dole out rather small halfpenny-worths to the owners of Grimalkins, as they have their profit to turn. The commercial products of the horse and other dead carcases, the useful applications of excrementitious and other waste substances, I have described fully in the catalogue of the animal products of the South Kensington Museum; as these are very generally known to the public, and the subject is not inviting for discussion before a general audience, I need not enlarge upon them here.

Neats-foot oil and trotter oil are products obtained in the process of boiling down calf's-feet and sheep's-feet; the former is used for softening leather and other purposes, the latter principally as a hair-oil.

Bladders of oxen, pigs, calves, and sheep are prepared for holding lard, tying down bottles and jars, &c. Quantities are imported from North America and the continent, packed in salt or pickle. Some of the gut forms cases for Bologna sausages, polonies, black puddings, preserved meats, &c., and they constitute the material of that very important substance—gold-beater's skin, the manufacture and use of which are valuable trades in London. Under the misnomer of catgut and catlings, there is a very important application of a waste material in the manufacture of the dried twisted intestines of sheep, for the strings of musical instruments. These are imported to the value of £2,300 a year.

All excrementitious deposits of animals are valuable as fertilizers for land, but those of the domesticated animals are of course most largely available.

Attention has frequently been directed to the substances wasted in the fisheries and returned to the sea as garbage, and to the detriment of the fisheries. The difficulty has hitherto been the collection and bringing together the refuse to one or more conveniently-situated manufactory. The preparation of fish guano, that is to say the transformation of the carcases and offal of fish into a manure adapted for restoring to cultivated soils their fertility, is a branch of industry which, I think, will in due time assume a remarkable extension.

The utilization of the waste products of the fisheries has often been discussed here, and its importance acknowledged, and yet comparatively little progress has yet been made in carrying out the subject on an extensive scale.

It is confessedly an object of the first importance to find an auxiliary or substitute for guano, which may check the excessive prices that now limit the consumption, and which shall afford a provision of artificial manure, when the supply of guano shall fail. Fish, the source of guano, naturally suggests itself. The supply is inexhaustible and almost unlimited. Reduced to its solid parts, it is a valuable concentrated manure, rich in the best fertilizers, ammonia and phosphates, while the gelatine and oil may be collected as merchantable products, which will generally pay the cost of converting the fish into manure, and perhaps leave a profit.

It has been ascertained, by multiplied and satisfactory experiments, and confirmed by actual working, that the waste and refuse fish may be thus converted, and the gelatine and oil collected. A new company has recently been formed to manufacture fish guano, and a patent is likewise secured for combining in a cheap and portable form all the nutritive portions of fish, and they are well adapted to support, efficiently and permanently, mental and physical vigour; it is easily preserved, in all climates, seasons, and circumstances, in a form the most concentrated and adapted for carriage; it is prepared with little trouble, and by its cheapness accommodated to universal use. The machinery and the process are most simple, inexpensive, and effectual. The resulting manure is a dry fibrous powder, which retains all the fertilizing powers of fish in a form most convenient for transit and distribution, whilst its appearance and sensible properties make adulteration palpable, since every one can judge for himself (by the mere inspection and smell), of its genuine character. The demand would certainly far exceed the utmost attainable supply, and, at a price moderate as compared with any other manure, it would give a very large profit to the manufacturer. The waste and refuse of a great fishing port will supply the materials cheaply and without much outlay, and as it will be a great gain to a fishing adventure to obtain a certain and constant demand for all this waste and otherwise unsaleable fish, the establishment of manufactories for fish manure will lead to new fisheries where, without such aid, they could not prudently be commenced.

Yarmouth, the chief fishing station in England, with the adjoining coast from Lowestoft to Aldborough, offers every advantage for such a manufacture. It employs nearly 400 boats, from 25 to 60 tons each. They ordinarily afford from 2,000 to 3,000 tons of broken fish and salt, selling at about £1 2s. per ton, besides the waste of 400 smoking-houses, sold as refuse; and from 500 to 700 tons of herring scales, a substance containing 16 per cent. of nitrogen and a very large proportion of phosphates, and obtainable for £1 10s. per ton. This is independent of the waste from occasional gluts of dog fish and others useless for food, of which no account is taken, yet which are caught in very large quantity, and of which an unlimited supply might be obtained if the fishers could obtain a sale. Last year, so great was the glut of herrings at Lowestoft, that, at one time, they were carted by the farmers at 4s. 6d. per ton.

An ample, cheap, and continuous supply would therefore be secured from the first, by simply taking from the fishermen what they will only be too thankful to sell; and the manufacture, which would be in every sense of the word a national benefit, may be carried on with no risk, small outlay, and large profit.

It would be a curious investigation to follow out the value of the street sweepings, scavengers' collections, ashes, &c., obtained in this metropolis and other large towns, but the subject would carry me too much into detail, and I have not the figures as to the large sums paid to different districts for the contract or privilege of carting away the waste.

The corporation of Antwerp, which used to pay £1000 a year to get rid of the refuse of their city, now receive upwards of £40,000 a year for the sweepings of the streets and the contents of the cesspools, contractors converting the nuisance into powerful guano. At Paris and Milan town guano is manufactured, which has extraordinary powers as a fertiliser.

The street pickers and sewer rakers, and the persons who frequent the river banks, &c., gather up rags, bones, metal, old boots and shoes,—in fact, anything that can be sold or reconverted to a useful purpose.

The boots and shoes go to the translators, vampers, and clobberers, as they are technically termed in Monmouth-street and the purlieus of Petticoat-lane and Rag Fair, where, by the use of the heel-ball and clobber, a mixture of ground cinders and paste, the crevices and breaks of our old "understandings" are filled up; and, when the cement is dry and a few nails and stitches are added, they are polished and disposed of to those who patronize or can only afford cheap shoe-leather.

Vegetable Substances.

There are some again who buy only the clippings of tailors, shirt and cap makers, and others engaged in the manufacture of dress. These gatherings are either sold to the piece brokers, or to the shoddy maker.

The itinerant clothesmen of the metropolis are pretty numerous, although I have no precise account of their numbers. In conjunction with the china and glass pedlars, and the vendors of growing plants and flowers, they collect worn-out garments, hats, boots and shoes, &c., which are renovated and made "better than new," for home sale, either in Holywell-street, the Minories, and the neighbourhood of the Tower, or in Monmouth-street, and such localities. Then there are the wardrobe purchasers, whose advertisements are seen continually in the *Times*, requiring garments for export. These classes furnish a considerable portion of the "apparel and slops," to the value of £2,000,000 sterling, annually exported, half of which goes to Australia.

The extent of this waste material trade, if I may so term it, may be estimated by the number of persons engaged in it in London, as gleaned from the pages of the Post-office Directory. This number, however, is necessarily far below the mark, as it only includes housekeepers, and many in the suburbs are omitted. There are, I find, 354 clothes salesmen; (these, perhaps, are not all vendors of *old* clothes, but include some of the outfitters,) an undefined number of wardrobe dealers, 160 rag merchants, 564 marine store dealers, 19 bone dealers (10 of whom are bone boilers), and 3 bone crushers.

Rags are the common emblem of poverty, and to say that a man is in a ragged condition is the worst thing that can be said of him; but rags are in fact a great source of wealth, and one of the staples of our commerce, for, besides our large home collection, we import cotton and linen rags, on the average of years, of the value of more than a quarter of a million sterling; and the whole quantity used in the kingdom is estimated to exceed one million sterling. During the late war there was an enormous demand for linen rags by the apothecaries to scrape into lint. Unless persons then have carefully examined the vast amount of the cost of rags, they can form no idea of their great importance. To make one pound of paper it takes one and a quarter pounds of rags.

Our imports of rags and other materials for making paper, in the last few years, have been as follows:—

Years.	Quantity. Tons.	Value. £
1854	11,415	255,910
1855	9,414	219,323
1856	10,284	230,116
1857	12,196	272,848

The largest quantities come from Prussia, the Hanse Towns, Russia, and Italy.

In New York there are more than 1,000 professional rag pickers, 100 wholesale rag dealers, besides 700 licensed and unlicensed junk shops, which buy rags from housekeepers and rag pickers, and sell them to the rag dealers.

It is a well-known fact that the supply of rags has been for many years very short, and every device that human ingenuity could invent has been resorted to to supply the deficiency. In place of rags the waste from palm-leaf manufactories, grass, bass wood, cane-trash, wood-shavings, birch bark, and a hundred others, have been tried in different quarters, out of many of which paper of a fair quality for wrapping purposes has been produced, but I am not aware that any of the finer qualities of paper have been manufactured from these articles.

There is a substance which is largely produced in the sugar-growing countries, the megass or trash, the fibrous portion of the stalk of the sugar-cane left when the juice is expressed. This is chiefly used, after being dried, as fuel for heating the boilers in which the sugar is made, although it ought properly to be returned to the soil as manure. It has been suggested that this would furnish a valuable paper pulp, being easily reduced, if the cost of the chemicals for bleaching it were not found too great. The remaining juice (for it is seldom sufficiently pressed in the mills) should be washed out, and the inner white fibre, rejecting the rind, soaked in a solution of carbonate of soda or potash. It is unknown how much sugar, convertible at least into rum, is burnt every year under the coppers on the sugar estates of our colonies. If this saccharine could be saved, and the larger portion of the megass converted into a cheap material for the paper-maker, a profit would be made, even after defraying the cost of other fuel, to supply the place of the abstracted megass.

Not only would the finding of a plentiful and good substitute for rags be of great importance in a pecuniary point of view, but it might be the means of preventing the spread of malignant diseases. Many a case of small-pox, yellow fever, plague, and cholera, are to be traced to the filthy rags carried from place to place.

The lowest price of common rags is £15 per ton, to which is to be added the loss of one-third before such rags are reduced into "half-stuff." Good linen rags are worth £28 to £30 per ton. One of our largest and best paper-makers has declared that "it is nonsense to talk of paper made solely from linen rags; linen rags," he says, "cannot be found, nor, indeed, any other rags in sufficient quantity to supply an increased demand; and that unless a new material be found, paper making will be at a stand-still."

Mr. F. B. Houghton has recently patented a process for making paper from any description of woody fibre, which is especially applicable to the manufacture of paper from flax-straw, or flax refuse. Flax-straw (shoves) can be procured at 50s. a ton, about 2½ tons making one ton of paper. Waste flax (the refuse of the scutching mills, from which no profitable results are obtained) can be procured at a mere nominal price, as it is burnt or thrown away. Now, as our imports of rough or undressed flax amount to 81,000 tons a-year, and our home growth of flax is extensive, there being 100,000 acres under culture in Ireland, there is plenty of raw material available.

Wheat straw, we know, affords a good pulp for paper, strawpaper, both for writing and printing, being now extensively used in France, in England, and the United States; but rice straw, which is plentiful in certain districts, would, I think, give a better pulp, as it is a tougher substance. It has often been said that there is nothing new under the sun, and that straw paper, to which attention is now so prominently pointed, was known and worked sixty years ago. I hold in my hand a curious book, the second edition of which was published in London, in 1801, entitled an "Historical account of the substances which have been used to describe events and to convey ideas from the earliest date to the invention of paper;" by Matthias Koops, Esq. It is printed, for the most part, on paper re-made from old printed and written paper. Part of the work is printed on straw paper and some on wood. The work is dedicated to George III. An Act of Parliament was passed in favour of the author's manufacture of straw paper, and he appears also to have taken out patents for making paper from hay, thistles, waste, and refuse hemp and flax, and different kinds of wood and bark, fit for printing and almost all other purposes for which paper is used. Then I have here two other applications of waste materials, a descriptive account of the cow-tree, by Mr. J. Murray, printed on paper made from the *Musa textilis;* and an illustration to which, is printed with ink obtained from the fossil sepia, contemporaneous with the *Ichthyosaurus!* While another pamphlet, by the same author, giving an account of Newzealand flax, is printed on paper made from its leaves, bleached. Both these were published in London in 1838.

In the words of a correspondent of the *Journal* five years ago, I may add that, with the immense resources which this country possesses in her tropical dependencies, more especially India, she should have the supply of the world with paper as she has of other manufactures, instead of being undersold; but new ground must be opened.

There are in the United States over 800 paper mills in operation, requiring about 3,000 engines to keep them at work, and they produce upwards of 270 millions of pounds of paper.

To show how important an article of consumption rags are, I append a statement of the cost of manufacturing this immense amount of paper:—

406,000,000 lbs. of rags, at 2d. per lb....	£3,383,333
Cost of labour at 1d. per lb.	1,691,666
Cost of conducting the manufacture......	810,000
	£5,884,999

In 1853, the import of rags into the United States amounted to 9,486 tons, valued at about £183,130. The principal portion of these was imported from Italy. Besides this large amount of raw material, the Americans import yearly about £200,000 worth of fine paper.

Although the quantity of paper used by different European countries in proportion to the number of their inhabitants is not to be compared with the amount consumed in North America, yet it is considerable, as the following figures will show:—

	Population.	Paper.
United States	25,000,000.........	112,500 tons
Great Britain	28,000,000.........	85,000 ,,
France	35,300,000.........	70,000 ,,

The consumption of paper is now large for papier maché articles, frames, and mouldings, &c., which are formed either of plain grey wrapping paper, pasted together in successive layers of the required thickness, paper-makers' pulp, or coarse paper cuttings, boiled and macerated to a paste, and then thickened and rendered adhesive by gum or by glue. Bookbinding and paper-hanging, which increase with the progress of wealth, population, and civilization, also make increased demands for paper, exclusive of the large consumption for printing, packing, carton pierre, and paste-board boxes, &c.

Cotton waste is the refuse cotton of the mill, being the "strippings" from the card, after the cotton has passed through the machine, the "flyings" or the portions which fly off from the card whilst the machine is in motion, the "droppings" and "blowings" which collect under the blowing machine in which cotton is cleaned, and the "sweepings" or gatherings from the floor of the card room.

The value of cotton waste varies with the price of cotton; strippings and blowings are worth about one-half to two-thirds that of cotton; and droppings, blowings, and sweepings, one-tenth to one-eighth.

The waste of cotton made during the process of manufacture, is, according to Mr. Ashworth, wrought into coarse sheets and bed-covers, which are sold at prices varying from 6d. to 9d. per lb. The residue of the waste is used for the manufacture of paper, the cleaner portion being for writing-paper; and the sweepings from the floors of factories supply a large proportion of the paper-mills of Lancashire with the raw material of the paper which is used for the printing of books and newspapers. The actual quantity of waste made must be very considerable upon a consumption of 800 or 900 million pounds of cotton annually.

Estimating it at 15 per cent., the usual allowance, there is at least 50,000 tons of cotton waste available, which, added to 20,000 tons of linen waste, and the same amount from rope and canvass, gives a large quantity to be worked up again. Previous to 1841 cotton waste was only used for making very common papers, but straw pulp being more generally used now for this purpose, cotton waste is chiefly worked up for printing-paper.

There are in Oldham 127 cotton waste dealers; in Manchester 82; and in other towns in Lancashire 244; so that there are probably 500 cotton waste dealers in the district. In America waste cotton is employed for the manufacture of articles of furniture, after the manner of papier mache; it is compressed into wood that takes a very beautiful polish.

The quantity of oakum sold in Liverpool, we are told amounts to 1400 tons a year, valued at £28,000, and the quantity used in London no doubt exceeds this, looking at the extent of shipping and the other uses to which it is applied.

Of codilla, or tow, the refuse or waste fibres knocked out of hemp and flax in cleansing and carding it, we imported in 1857 nearly 13,000 tons, valued at £373,000. It is made into bags, sheeting and yarn, and used for other purposes.

By machinery in the United States and on the Continent, the cotton surrounding the seed is taken off, and can be sold to carpet manufacturers and paper-makers. At Antwerp, it realises about 12s. 6d. to £1 the cwt. Recently, in speaking after Mr. Wray's paper on American cotton cultivation (see *Journal*, vol. vii., p. 86), I pointed out in detail the enlarged and very important uses of the cotton seed, formerly a waste substance, and the valuable commercial products now obtained from it, and I need not, therefore, enter again into the details, but I may exhibit a specimen of refined cotton seed oil, now coming extensively into use to mix with rape oil for burning, and to adulterate olive oil.

Waste paper clippings and cuttings are bought up at from 1s. 6d. to 7s. 6d. per cwt. for common, up to 21s. per cwt. for the best clean white, such as the trimmings of bookbinders, envelope-makers' cuttings, the shredding from the plough-knife in cutting post and foolscap, &c. The best is worked up again for white paper, and the more common and coloured kinds for packing-paper and paper-hangings.

The twitch or couch grass, which has hitherto been such a troublesome weed to the farmer in clearing his land, is now turned to several useful purposes. In Italy it is used as food for horses and cattle. Colonel Maceroni, in his memoirs states that upwards of £40,000 sterling worth of this root is annually sold by the peasants to the inhabitants of the city of Naples. In France it has a medicinal repute under the name of dogs' tooth. It has been tried as a material for paper, and is collected in large quantities in the fen districts, and sold to the paper-makers at about 12s. a ton, instead of being dried and burnt as heretofore.

Thus we perceive that the sweepings of our cotton and flax-mills, the outside wrappers of the cotton bales, however discoloured or dirty, the weeds of our fields, thistles and couch grass, the stalks of reeds and canes, sawdust and pine-shavings, the refuse of the Irish flax scutching mills, moss and furze, our cast-off garments, the beggars rags, old sacks, and worn-out ropes, all of which we should be troubled to dispose of, are converted by the paper-maker into an article indispensable to civilized man.

The dry residue of the beet root, after expressing the juice for sugar, consists chiefly of fibre and mucilage, and amounts to about one-fourth of the weight of the clean roots used. It is greedily purchased by the farmers on the Continent, with the skimmings of the boilers, which are found to be a powerful manure. It is also useful as food for cattle.

Mixed with other substances it makes very good paper. In France pasteboard is also made from the pulp. This fabrication is carried on to some extent in the commune of Fontaine (Haute Marne), and can be employed, it is said, with advantage in ornaments, tea trays, and other such articles.

As the beet-root sugar now made on the Continent amounts to about 200,000 tons, the quantity of residue must be considerable. The residue, too, of the molasses after distillation for alcohol can be converted into excellent potash, the proportion obtained being about one-sixth of the quantity of sugar extracted from the beet.

Tan pit refuse, or the desiccated ligneous matters of the bark and valonia used in tanning, has been converted into charcoal with some success. Tan or spent bark has also its use in hot houses or bark stoves for forcing plants, and the spent dyewoods are converted into charcoal.

There are a variety of what are termed silk cottons, which have hitherto been comparatively waste substances. Some of these are now, I think, likely to be commercially utilised, for there has been inquiry for them in the manufacturing districts.

Among others, I may particularise the vegetable silk (*Chorisa speciosa*), from Bengal, which has long been used for stuffing cushions, and a kind of wild cotton down, with a fine glossy fibre, like silk, which grows abundantly in the valley of the Amazon, and is used at Guayaquil and other localities to fill mattresses and cushions.

Silk-cottons are obtained from *Bombax*, *Calotropis*, *Cryptostegiœ*, &c., in different districts in India. These are not marketable, though silky, and can be worked up with the real cottons. There is something similar to the above obtained apparently from a grass, native name "jummoodoody," only fit for paper-making.

The seed vessel of the *Calotropis gigantea* produces a silky kind of cotton, which has been made into cloth in India.

The cottony seeds of the *Bombax pentandrum* are used in the East as soporific pillows, like those famous poppy ones of Somnus, or as the hop is often prescribed here. The silk down, moreover, forms an excellent moxa.

Under the name of kabu-kabu, this silk cotton down is used for stuffing beds, pillows, &c., in Sumatra. The *Bombax malabarensis* furnishes a similar downy fibre, known as moc-main.

The bombax-tree cotton-down is used in the Deccan as a stuffing material, and the tiny humming birds use it to line their nests. It has been shipped from the Deccan to the United States for hat-making.

The cotton of some species of the *Eriocephalus* of Africa appears to have much tenacity, though probably open to the objection of being too short in the staple, and of growing in too minute quantities. The cotton does not grow in the capsule, but between the corolla and calyx of the flower. Each plant bears freely, and plants may be raised from seeds or cuttings.

The pods of *Eriodendron samauna* and the *E. anfractuosum* (Dec.), furnish a silky down in Brazil, which is used for stuffing cushions.

A species of *Asclepias*, resembling a wild asparagus, which grows in the greatest abundance over almost the entire country in Canada, furnishes a fine silky down in its pods, which has been applied with success to the manufacture of hats in the province, being worked similar to hare and rabbit down. It is sometimes mixed with a fourth part of wool. Were it to engage the attention of the manufacturers of textile fabrics, it might be employed for a profitable purpose.

Few of these silk cottons could be made into a strong textile fabric, as they are destitute of all felting properties, but they would undoubtedly fulfil all the requirements of the paper-maker.

The importance to which the article of coir, the fibrous husk of the cocoa-nut, has risen of late years, is a proof of what an extensive trade may spring up out of a waste substance. It is now imported to an immense extent, in the form of rope, yarn, junk, fibre, &c., and is largely used for cocoa-nut matting.

We imported in 1857 cocoa-nut fibre of different kinds, from the husk of the cocoa-nut, weighing 75,510 cwts., and valued at £102,000.

Other useful products than the grain and its leafy covering have been obtained from the maize. Sugar and molasses have been procured from the stalk. The grain is largely used for distillation. A bushel of corn gives over a pint of oil, which is easily purified, and burns with a clear bright flame. A distillery has been established in the vicinity of Lake Ontario, where oil is extracted at the rate of 16 gallons from 100 bushels of Indian corn, leaving the remaining portion of the corn more valuable, and in better condition for distillation than before the oil was extracted. The cob is given as food to live stock, and has also been ground to make a kind of bread.

The husk of the Indian corn or maize is used for packing oranges and cigars, and for stuffing mattresses in America. Paper is also made there from the husks of the Indian corn. As the annual crop harvested exceeds 600,000,000 bushels, there ought to be plenty of raw material from this substance. Most of the American printing paper is made of cotton, on account of the extensive use of that article, and hence it is soft, easily torn, and perishable. The husk of the maize is a very fair substitute for horse-hair, possessing considerable elasticity, and may be had in any quantity, and at a comparatively small price.

The kittool palm fibre, the piassaba, the Mexican grass, the Esparto, and other substances, formerly waste or little known, have also become extensive articles of commerce.

Under the commercial name of Spanish moss, the long horse-hair like fibres obtained about the Missisippi from an epiphyte (*Tillandsia usneoides*), are largely used in America in upholstery purposes, for stuffing cushions, mattresses, &c., possessing considerable elasticity. Naturalists also use it for stuffing birds.

Another fibrous material, introduced as a substitute for animal hair for mattresses and upholsterers' work, is the Esparto grass curled and dyed.

Dr. Terry, of Detroit, in America, has made paper from a so-called moss; and this manufacture has attracted considerable attention in Texas, for there is a region of country there extending one hundred miles from the coast, where an immense quantity of this article can be obtained. The gathering and drying of it requires little or no capital in preparing it for market, and I doubt not, if this business is extensively carried out, that large quantities of the finer quality, instead of being converted into paper, will find their way into the hands of the mattress-makers.

The manufacture of bagging for cotton from moss was not long since tested in Missisippi, and appeared to be of a useful and durable character. The moss was obtained in inexhaustible quantities in the woods, at about 1½d. a pound for the collection, and as 2½d. more amply covers the cost of manufacture, the article could be furnished at about 4d. a yard. The demand for wrapping-cloths for the 3,000,000 or more bales grown in the United States is consequently extensive, and the coarse gunny bags, made of jute and sunn fibre in India, are largely imported. These gunny bags, and old rope or junk, are, after use, ultimately worked up into paper. I have here specimens.

The chippings and pieces of the cork-cutter are now extensively used for laying on the floorings of suspension bridges, embedded in asphalte or some composition. The foot-ways and carriage-ways of the new Chelsea bridge were so formed.

The palm oil of commerce, which is now imported to the extent of 42,785 tons a year, is entirely made from the sarcocarp or the fibrous pellicle that surrounds the nut; and the kernels, with the exception of an insignificant quantity used for the manufacture of oil for domestic uses in Africa, were formerly thrown away. Within the last few years, however, they have been utilized, and the shell being broken, the kernels are shipped to be pressed for oil, and a vast extension of the African trade will arise out of this new article of export.

Mr. C. Heddle, the leading merchant of Sierra Leone, a reliable authority, furnishes some useful data as to this new export. The 50,000 tons of palm oil shipped from Western Africa should give, he estimates, 10,000,000 bushels of kernels, equal to 223,000 tons. The average yield of oil from these kernels being 30 per cent., the 223,000 tons would consequently furnish 76,000 tons of oil, worth at the present price of cocoa-nut oil, which it closely resembles in all its properties, nearly £3,000,000. If we add to this the value of the cake, 112,000 tons, at the very low price of £5 per ton, we should obtain £560,000, making the whole gross value upwards of £3,500,000, or half a million above all the tallow imported into this country.

The waste liquors of soap and stearine candleworks are now converted into that valuable substance glycerine. Oleic acid also takes the place of olive oil in preparing wool, and their other residuums are applicable to various purposes.

The cake or marc of the olive remaining after the oil is expressed, is used in Sardinia, Italy, and other districts for manure and for cattle food. The poonac or refuse pulp, after pressing cocoa-nut oil, is also a valuable fertiliser.

The walnut is the olive of Savoy and the Bernese Alps, supplying the inhabitants with oil not only for home consumption, but for export to France and Geneva. The kernels are crushed by a mill into a paste, which is pressed to extract the oil, and afterwards dried in cakes, called *pain amer*, which are eaten by children and poor people.

About 1,200,000 pounds of walnut kernels are annually consigned to the oil-press in Cashmere, yielding about half their weight in oil, and the other half in cake, which is much valued as food for cows in winter, when it is usually exchanged for its weight of rough rice.

The various oil-cakes which are prepared here, or imported from abroad, are a utilization of waste substances of a very important character. They enter into commerce for feeding cattle and for manure. Of these rape, linseed, and cotton-seed cake are the principal, but all the marc or cake from the oil mills, whatever seed is crushed, is useful to some extent. Our imports of oil-cake have largely increased, reaching now 100,000 tons a year!

It appears that there is an article manufactured in the neighbourhood of Liverpool, called shude, of the value of £3 per ton, and supplied to many oil crushers to mix with linseed cake, to the extent of thirty per cent. and upwards. It is made from the husks of rice and the refuse of rice mills. It is perfectly tasteless, and yields no nourishment. Its colour and price make it a favourite article, and in great demand with dishonest crushers to mix with cake. One grinder of shude has sold to oil crushers during the last nine months nearly 2,000 tons.

The charred husks of the grape and residue of the wine press, are used for making blacks, or the choice ink used in copper-plate printing.

Rape, or the refuse raisin stalks and skins left after making British wines, are used by vinegar makers, the vinegar being filtered through the mass in large wooden vessels.

In cleaning paddy or rice, the rough silicious outer covering, which is impervious to water, forms a useful litter material for stables, and for packing crockeryware or ice, instead of sawdust. There is also separated in the process of husking a bran or fibre, covering the white rice, which is a most excellent food for horses, milch cows, pigs and poultry. The uses of chaff I need not allude to.

The bran or exterior husk of wheat in the process of grinding and bolting for flour, besides its nutritious properties for feeding, has commercial uses in tanning, in calico printing, for stuffing dolls, filling cushions, &c.

I cannot exactly trace the destination of the waste bread from the bakers, and that bought at the rag and other shops from the beggars, servants, &c. Professedly it goes to the waste tub for fattening pigs. Bread raspings from French rolls and overbaked loaves are used for covering hams, and occasionally as a poor substitute for coffee among the lower classes. But I have at least more detailed information as to the application of the waste bread of the French capital.

There is a man in Paris named Chapellier, who has made a noble fortune out of the collection and disposal of waste substances. He commenced as a *ravageur*, that is, a gutter-raker, who searches for horse-shoe nails, pieces of copper, brass, or other substances, which he sells to the dealers in those articles. Then he became a *trilleur*, in the service of a wholesale *chiffonier* of the Montagne Saint Geneviève, his duty being to sort the contents of the chiffoniers' baskets, and arrange them in the warehouse until they can be sold. In the course of this occupation he was struck with the pieces of bread they brought in and could not sell. It occurred to him that these could be utilized and turned to profit, and he set up in business on his own account. He made bargains with the chiffoniers, the scullions of the restaurants, and the cooks of all the schools, colleges, and convents, and he established himself in the very centre of the Halles as a vendor of bread crusts. These were largely in demand for feeding rabbits, poultry, dogs, &c., and in four months after his first appearance at the foot of the Fountain of the Innocents, he had three horses and three waggons continually busy collecting bread crusts.

In a few years he retired upon what he considered fortune enough, but, after the first month, he found himself more miserable than he had ever been in his life before, and was fain to return to his old haunt on Mount St. Hilaire. He now struck out a new line of business. He noticed that the cooks, butchers, pork-sellers, those who fry fish, and others, used a great deal of bread-crumbs for cutlets, *gratin*, &c. These made from stale bread, pounded or grated, were sold at 8 sous the quart. He manufactured wholesale, and sold at half this price, and soon drew nearly the whole of the trade to himself. He again returned to his old business, buying out his successor. Noticing in the waste bread he received that there were two sorts, the good and the bad, he thought of separating them, but found the profit would not compensate the trouble. He determined to invent a new industry. He made *croutes au pot*.

The stranger who goes to Paris should never order *soupe au pain* or *purée au crouton*, except at the Trois Frères, the Café de Paris, or some such establishment. All comes from the fabrique of Chapellier, from the chiffonier's basket, the college scrap-basket, the convent slop-tub. He has established, near the Barrier St. Jaques, ovens which never cool, and from which thousands of pounds of bread are daily poured forth, to be sold as crumbs or crusts. A large number of men, women, and children are busy piling and grating the merchandise, as it comes out of the oven. The carbonised pieces and scrapings are pounded, sifted through silk sieves, and sold to the perfumers to make tooth-powder.

Nothing is more curious than the warehouses of Le

Père Chapellier. They are immense buildings, where mountains of bread are received every minute. Workmen separate these pieces; on the right are those redestined for man; on the left those intended for rabbits. Wonderful order and cleanliness are everywhere visible. Young girls make up packages of *croutes au pot*, after weighing them. Children fill large boxes with the black powder. The master himself is always present among his workmen, scolding, giving orders, laughing, joking. He is a man of genius, and his annual income may be reckoned by tens of thousands of francs.

Under the names of "brick tea" and "sealed tea," a large commerce is carried on in Asia, in a strange article consisting of a compost of the spoiled leaves and stalks of the tea plant, with the leaves of some wild plants, and bullocks' or sheep's blood, dried in the oven. Each brick or package weighs about three pounds, and it is so firmly pressed together that nothing less than a hammer or chisel will separate it.

In Irkutsk, where an imitation of it has been attempted, elm leaves, sloe leaves, and some others have been substituted with success for those of the wild plants of China. When it is prepared or infused, it yields a thick, deep, red-coloured fluid, bitter and disagreeable to the taste. On the surface of the fluid floats a viscous fatty substance, which the Chinese declare not to be unwholesome, and to be used in order to make the tea stick firmly together in the package.

The leaves of this tea are old, and tough as leather, the mixture of twigs and stalks being also considerable.

The commonest kind of brick tea is sewed up in sheepskin, the more friable masses are packed in paper and sealed. The Tartars and Thibetans make a soup of it, with rye meal, milk, mutton fat, and salt.

"Lie tea" is made from the sweepings of the Chinese tea packing-houses, consisting of the broken leaves of all the various teas, damaged and spurious, dust and dirt, cemented together with rice water, or the serum of the blood of animals, and rolled into grains.

Another variety, from the same source, called "little tea," "tea endings," "tea bones," anomalistic in name as well as quality, is shipped to different quarters, for the purpose of adulterating wholesome and good teas. This is the sweepings of the "hongs," consisting of the dust of green and black teas passed through sieves to make it uniform in size. There are millions of pounds of damaged teas, musty, decayed, and those that were once infused, sent to the United States, and this lie tea has been shipped to our ports here, but met with no success.

The recovery of starch from rotten potatoes, and damaged grain, and refuse rice is a utilisation of waste substances, and this has been carried further still in the employment of horse-chestnuts for the purpose.

Horse-chestnuts, which have hitherto been a waste substance, are now utilized, and by removing the bitter principle excellent starch, as well as vermicelli and macaroni, are made from them in France. The following is a plan of making flour from horse-chestnuts. Grind the horse-chestnuts and mix with the pulp carbonate of soda in the proportion of one or two per cent., and then wash the produce until it is perfectly white; 1lb. of carbonate of soda will purify 100lbs. of horse chestnuts, and produce 60lbs. of flour fit for bread, as the salt removes the bitter principle from the nut.

In Saxony great care is taken to collect the horse-chestnuts, which are regarded as a wholesome aliment for sheep, and a specific against the rot, being given to the sheep in autumn, when the green food ceases. The chestnuts are cut into pieces, and this it is dangerous to omit, as they might otherwise stick in the throat of the animal, and cause its death. Sheep as well as cattle refuse at first to eat this food; but, when accustomed to it, they seek it with avidity, and even like to eat the prickly husk in which the nut is enveloped."*

The French make good coffee out of roasted acorns, and there is yet abundance of scope for experimental research upon new roots and seeds.

Brewers' grains, the spent malt of the brewery, is used for feeding milch cows and swine.

Malt commings, the shoot of the barley after being kiln-dried, is used as a coffee adulteration, as well as by farmers for manure.

We do not cook our peas in the pod, or eat the pods, as they do in France, although they are largely fed to milch cows in the metropolis during the season; and van-loads of the pods may be seen carted away from Covent-garden to the different dairy establishments. Several hundred females are employed shelling peas in the neighbourhood of the market. The pea-shells have been recommended as a paper material, and they have been used for distilling from in France.

The waste made by the sawyer or turner, wood-dust of various kinds, has several uses. Mahogany dust is employed for smoking fish; box-dust for cleaning jewellery, being sold at 6d. per quart.

The shavings or refuse in making cedar pencils from the wood of the Virginia or American cedar, are used up to make the otto of cedar wood, a hundred weight of shavings producing about 28 ounces of the otto of cedar. Sandalwood-dust is used to fill scent sachets.

Saw-dust is extensively used for sprinkling the floors of public rooms, butchers' shops, in wine cellars for packing bottles, for stuffing dolls, and by many manufacturers; as by the needle maker, and the nail and screw maker. It is also in large demand in America for packing ice for shipment.

A large quantity of tobacco is destroyed from time to time in the customs kiln, termed the Queen's tobacco pipe, in the London Docks, and the ashes are considered a good manure. A few tons of these ashes, purchased of the Customs, are occasionally advertised for sale.

The numerous uses of seaweed, present and prospective, I can scarcely touch upon. This waste substance, to be obtained on our own and most shores in such boundless profusion, is too much neglected. An inventor proposes to make paper from it, and a French engineer speaks in raptures of it as a building material, describing it as an excellent lining for roofs and walls; among other advantages it is almost incombustible, and will not harbour vermin. We derive from seaweeds now several valuable chemical products, such as iodine; and acetic acid might be obtained from them. Their food properties I have already touched upon in the pages of the Society's *Journal*, and it is to be hoped the liberal sum offered by Sir. W. Trevelyan as a prize for the best treatise on their economic uses, will lead to a valuable fund of information.

And now for a few words on MINERAL SUBSTANCES.

Professor Crace Calvert, in a valuable paper (*Journal* vol. iii., p. 17), went into the various new or residue products of coal, exclusive of coal gas, such as first the coke, next the liquid portion, which is bought by chemical manufacturers, who obtain from it sulphate of ammonia for agricultural purposes, and salammonia for soldering, and which is also used in calico and print works for producing the style of prints called "steam goods." And from these two salts is also obtained hartshorn, extensively employed in pharmacy. Ordinary coal gas liquid is also often employed to obtain by distillation common ammonia, much used in dye works, and to produce with lichens the beautiful colouring matters called orchil and cudbear. Many hundreds of thousands of gallons of ammoniacal liquor are used in the preparation of ammoniacal alum. To obtain this and other refuse products of coal, aluminous shale comes largely into use, and shale oil is applied as manure.

Coal tar (of which about 300,000 tons are made yearly) furnishes a chief ingredient of printers' ink, in the shape of lamp black; it is also made into asphalt for pavements, and mixed with red-hot clay forms a charcoal that acts as a powerful disinfectant; with coal-dust it forms, by pressure, an excellent and compact artificial fuel.

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*Lasteyrie, on Spanish Sheep.

Carbolic acid possesses extraordinary antiseptic properties, and carbo-azotic acid gives magnificent straw-coloured yellow dyes on silk and woollen fabrics.

Crude naphtha, used for burning, benzine or benzole for removing grease spots, paraffine oil, extensively employed as a lubricator in the cotton mills, &c., are other commercial products, formerly waste or unapplied.

Breeze, the small dust coal of the mines, and screenings from house coals, is pressed into cakes of artificial fuel. The ashes and small cinders sifted from the ash-pits and dust-holes are used for making bricks.

Soot, again, is largely collected, and sold by the chimney-sweepers at 6d. a bushel for transmission into the country as manure.

Of argol, the sediment of wine vats and casks, we import now about 1,000 tons. When purified, it is denominated cream of tartar, and is much used by dyers as a mordant, to prepare the stuffs to receive their colours. About 1,000 tons of cream of tartar are also imported.

Glass bottles are always saleable at the bottle warehouses and the rag shops, wine and soda-water bottles fetching about 9d. to 1s. a-dozen, and doctor's bottles 3d. a-dozen. Flint glass is also a saleable article, being worked up again, and I am informed that there are from 1,000 to 1,200 tons of broken glass bought and used up annually in the few glass-works of the metropolis.

Ice is certainly a waste product, which is now, however, extensively utilized for cooling wines and other beverages, for making ice-creams, preserving fish, &c. As we get but little now-a-days from our own ponds, owing to the milder character of our winters, whenever a sharp frost does set in, the ice that forms on the water is immediately carted away to the cellars and vaults of the dealers. But it is in warm climates where ice is considered the greatest luxury, and is in most extensive demand. In the United States it has become an indispensable article of consumption, its sale having risen to an important trade, both for home use and for foreign customers. The city of Boston is the chief port of export, upwards of 1,500,000 tons being now shipped, two-thirds of which are sent to the southern cities, and the greater part of the remainder to South America and the West Indies. Some, however, is shipped to Great Britain, the East Indies, and Australia. New York consumes about 350,000 tons of ice yearly, Philadelphia, 200,000 tons; while the domestic consumption in eight other leading cities is about 250,000 tons.

"Jewellers' sweeps" is a general name for the scraps and dust remaining in silversmiths and jewellers' workshops, gold pen maufactories, &c., which are bought by persons who smelt it over again to separate the gold and silver from the refuse. Even the clothing, waistcoats, jackets, &c., of gold beaters and other workers in the precious metals are eagerly bought up for the recovery of the fragments accumulated in them, and I have heard of fabulous prices given for an old waistcoat that had been long worn by a gold beater. At any time they can readily obtain a new waistcoat for their old one.

Horse-shoe nails, kicked about the world by horses innumerable, are not the useless fragments we might naturally deem them. Gun-makers tell us that no iron is so well fitted for their purpose as that which is derived from horse-shoe nails and similar worn fragments. The nails are in the first instance made of good sound iron, and the violent concussions they receive when a horse is walking over a stony road, give a peculiar annealing and toughening to the metal, highly beneficial to its subsequent use for gun barrels.

The scrap iron from needle-making and other manufactures is also sold by cart-loads, for making gun-barrels, as it is the finest-tempered steel.

The waste metal in cutting up steel pens, at Birmingham, is returned to the Sheffield steel converter, to be worked up again, an allowance being made for it of £10 per ton, the original cost being £50 or £60 per ton.

Steel filings are sought for by the chemist to make steel wine. Barrels of brass-filings are also saved at Birmingham, fetching about half the original cost of the metal.

In the manufacture of tin-ware, there is a large waste of the raw material in the shape of clippings and pieces, and as this waste consists of the two useful metals iron and tin, attempts have been made from time to time to reclaim each metal separately, with a view to utilise them. The tin, which demands, from its great value, the highest consideration, is first separated from the iron by an acid, and afterwards, by chemical means, restored to the metallic state, but the difficulty has been hitherto to keep the restored tin quite free from iron—the presence of which, though in minute quantities, effectually neutralises the most valuable property of the tin. The great bulk of these clippings, however, is iron, which by the process of heating and melting, can be reformed into bars; and as a large proportion of the tin plates used in the manufacture of tin-ware, is composed of charcoal iron, a very fair quality of bar iron might with care be produced, but this can only be accomplished by the introduction of hammers into the furnace itself, whilst the iron clippings are hot, as from their slight substance they would not retain sufficient heat if withdrawn for the hammering process in the ordinary way.

The subject is evidently worth attention, as many hundred tons of tin clippings must be produced annually in this country, the make of tin plates exceeding 60,000 tons, and the exports having trebled in the last ten years.

There are about six or seven lbs. of tin to every 100 of clippings, so that in 100 tons of this refuse material we should obtain, say, betweeen five and six tons of tin, and perhaps 90 tons of iron. The loss from dirt is comparatively trifling, as the clippings are almost invariably quite new and clean. The clippings, I believe, are likewise used as a flux in the smelting of antimony ores.

Scrap iron, the cuttings and parings of iron work, are collected and melted again in the puddling furnaces.

Anyone visiting the docks will occasionally see barge-loads of old iron being shipped as dunnage or ballast in vessels bound for the United States or for the continent. It comprises a heterogeneous collection of all descriptions of articles, frying pans and gridirons, saucepans and candlesticks, tea-trays and boilers, shovels, and old corrugated roofing, and many are the jokes of the men who bundle in this old iron. It is the accumulated produce of the old-iron shops, the collection of the mud-larks of the rivers and other itinerants. In 1857 we exported 36,500 tons of old and broken iron, chiefly to the continent.

There is a greyish powder produced by the solution of sugar of lead in vinegar, which consists almost entirely of silver in a state of very minute division, and which, with other chemical refuse, formerly wasted, is now applied to useful purposes.

The shells from the shell banks on parts of the Chilian coast are collected by men employed for the purpose, and are purchased by the copper smelters, to burn into lime for mortar, as well probably as for a flux in their smelting operations. These shells also furnish the lime that is so much used by the Chilians for whitewashing their houses. Shell lime mixed up with ground dinas brick, and salt-water, makes a most durable kind of mortar for that climate; so firm does it set, that on knocking down an old wall, the stones will often break rather than the mortar.

These, then, are a few instances of the utilization of waste substances. They form of course but a tithe of those comprehended in so wide a subject. Some of them are amusing, many instructive, exemplifications of the profit to be derived from the collection and utilization or re-application of waste products.

DISCUSSION.

Mr. Warriner said the article seaweed, which had been alluded to, was very abundant upon our coasts, particularly on those of the west of Scotland and Ireland. After a storm from the north-west it was incredible the quantity of seaweed that was thrown up, and which probably remained until it was carried away by another storm. Some valuable and important articles of food were at present obtained from seaweed, the best known being called laver. Some kinds of seaweed formed a valuable food for cattle, and there was also a description of seaweed which he had seen in masses as large as his body, which, if reduced to a pulp, made an excellent article for the manufacture of paper. The difficulty was in getting the pulp made on the spot where the article was found, for it was liable to ferment if conveyed to a distance. If, however, it were mixed with certain proportions of glycerine, it could be sent to any part of the world without deterioration from fermentation, whilst the glycerine itself gave a glossy surface to the paper. With regard to the refuse of fish, this was scarcely used at all in this country. If the refuse of fish, which could not be preserved by dessication in Ireland, or Scotland, or Newfoundland, owing to the humidity of the atmosphere—if this were mixed with glycerine, large quantities of it could be made available for this country. The article of buttermilk had not been alluded to in the paper. In many parts of Ireland, owing to the want of proper treatment of that article, a large proportion of the buttery matter was given to the pigs. It should, however, be known, that a very small quantity of bi-carbonate of magnesia put into the milk when warm, or a little of the same substance thrown into the pail before milking, would enable five per cent. more of the buttery particles to be obtained. Another article alluded to was bones, in reference to which great extravagance generally prevailed in the domestic circle. Very few families thought it worth while to boil the bones which remained from the joints of meat; they were the perquisite of the cook, and as such found their way to the bone-dealer; but by boiling them a large amount of nutritious food could be obtained, and the bones themselves would still be serviceable as an article of commerce. The 70,000 soldiers who were upon an average in this country received rations of three-quarters of a pound of meat per day each, and of that quantity it might be calculated that one-tenth consisted of bone, a fifth part of which consisted of valuable gelatine. If that were the case, there was now a large amount of waste. During the last month he had visited upwards of 100 public institutions in London, where, in the majority of cases, copper utensils were used for cooking. In most instances an inspection of these coppers showed that the tinning had been removed, and considerable quantities of verdigris had been generated, which might be highly detrimental to health. Thus it might be said that a large number of people were daily fed with food which might almost be called poisoned, and this was caused by want of proper attention to the utensils in which it was cooked. Seeing many medical gentlemen present, he thought it his duty to mention this fact, in the hope that, in the public institutions to which he alluded, the example recently set at Christ's Hospital would be imitated, by removing the copper utensils and substituting those of metal less liable to generate substances deleterious to health.

Mr. Hyde Clarke, after making a few remarks on other subjects, said he wished Mr. Simmonds had mentioned tea seed oil, and tea seed cake, now of considerable importance to the Darjeeling settlers, for whom he (Mr. Clarke) was agent, as well as to the other settlers in India. He observed that an account of the agency by which waste products are utilized in London, Paris, and other large cities, might be a valuable means of contributing to their further utilization. Although Mr. Simmonds had spoken of thousands of tons of animal and vegetable products treated as waste, yet in the mineral manufactures hundreds of thousands of tons were wasted, besides causing injury to human health. From the stacks and chimnies of our works enormous quantities of sulphur, arsenic, and other substances useful in the arts were sent out to be wasted, and not only these, but quantities of the common metals, and even of gold and silver. The abundance and cheapness of our fuel led our manufacturers to regard processes for economy with less attention than where fuel was dear. Thus such a process as that for applying the waste gases of the iron furnaces in smelting, had been employed for nearly twenty years in France, Belgium, and Germany, whereas it had been only lately applied in South Wales.

Mr. Campin would remark, with regard to the utilisation of leather waste, that some time since a German gentleman, with whom he was acquainted, took out a patent for the manufacture of paper from leather shavings. The plan was to remove every substance, except the gelatine, which admitted of being mixed with rags or other paper material. He was not aware, however, to what extent this process had been carried out in practice.

Dr. Lankester, F.R.S., said that each subject inintroduced in the paper would in itself form the matter for a most useful and interesting discussion; but before they could think over one subject another of equal interest was presented, and the paper proceeded in that manner like a series of dissolving views. He had, in his own mind, fixed upon the utilisation of sewage as a subject of great importance to be discussed, but other matters had been introduced, perhaps of equal interest. He was struck with the remarks of a gentleman who preceded him upon the subject of the utilisation of seaweed, and he was glad to find that a premium had been offered through this Society for the best essay on that subject. He hoped Mr. Simmonds would be induced to employ his talents in that direction, for, with the means of research which he had at his command, he thought if it were known that he intended to take up the subject, very few would compete with him for the £100 premium that had been offered. He (Dr. Lankester) would remark that they ought to be careful how they encouraged the notion that seaweed itself was valuable as a substantive article of diet. Food prepared from that commodity did not contain nutritious or flesh-giving matter. It contained the starchy matters in considerable quantity—the heat-giving substances; but it was a mistake to suppose that these gelatinous substances were really nutritious. They could be used as additions to other descriptions of diet; and in that way alone such substances ought to be employed. There had recently been an arrival, at the South Kensington Museum, of specimens of Chinese food, including articles prepared from various kinds of seaweed, and a specimen of the description of weed used by the swallows in building their nests, which formed a well-known Chinese delicacy; but it was to be observed that these were not used as substantive articles of diet, but merely as additions to other viands, and as a table luxury. In that way only he advocated the use of gelatinous substances as articles of food. There was as much error prevalent with regard to the gelatine of bones as to that of seaweed, for there was no proof that gelatine became part and parcel of the human body. Much as they doubtless relished that savoury preparation—turtle-soup, they must not suppose that it was really a nutritious food. Milk was the great type of all food, and contained all the elements essential to life, but no gelatine was found in it, and the same might be said of the blood. Gelatine might, however, be utilized with valuable results in manufactures, but not, he thought, to any great extent as affording an article of diet. Mr. Simmonds had alluded more especially to the utilization of certain sewage products, but that was almost too wide a subject to be touched upon on the present occasion. There was a principle, however, which must always be looked to in the consideration of this subject, which was, whether the cost of the preparation was not greater than the value of the substance which was produced; and with regard to sewage it was not until they could separate the fertilising properties at a cost which would enable the farmer to use them profitably, that the utilisation of that substance would be carried out to any great extent. He believed it would never be accomplished under the present aquatic system of sewage that was now adopted in London and the other large towns; and that introduced the question—rather a startling one—whether the aquatic system ought not to be abandoned. Illustrations were not wanting to show that sewage operations could be successfully carried on upon other methods than the aquatic system. At Aldershot a different plan had been adopted, and the sewage was being utilized. It remained, therefore, to be shown that what was applicable in the case of large bodies of men in camp was not exactly applicable to large bodies of the community in cities and towns. He hardly knew whether it was right on his part to infuse any doubts into the minds of the Metropolitan Board of Works, who had been preparing for an expenditure of some millions of money in order to carry on the aquatic system of sewage upon a yet larger scale, and thus, in his opinion, to render the chances of any successful utilization of the products more and more remote. Before sitting down he wished to express his high sense of the value of the paper with which Mr. Simmonds had favoured them, from which, he believed much good would result. He would take this opportunity of suggesting that much service would be rendered to the manufacturing community if a list of such substances as were at present more or less regarded as waste, were published, as well as a list of those which were being utilized. Many manufacturers, doubtless, were unaware of the utilization of various products that were being produced in the present day, while others were equally unaware of the purposes to which those products were capable of being applied.

Mr. William Stones begged to express his thanks to Mr. Simmonds for his able illustration of the advantages to be derived from following the great example set by nature. He had, in fact, given a lucid explanation of the high command "gather up the fragments that remain, that nothing be lost." As a record of the progress which had been made in this respect, the paper needed no commendation from him. Mr. Simmonds had referred to the subject of straw-paper. The book which he held in his hand was printed upon straw paper 60 years ago, and from that time to the present, various attempts had been made to improve that manufacture, with more or less success. In 1851, a vigorous attempt was made to develope that manufacture, but great difficulty was experienced owing to the expensive nature of the chemicals employed for treating the article. This had been to a considerable extent overcome, and paper of good quality was now largely manufactured from straw. Mr. Simmonds had, however, suggested that rice-straw was a better material for the purpose. Now, wheat-straw could be bought in this country at from 25s. to 30s. per ton, with an unlimited supply, and it seemed to him rather unpromising to go to India for rice-straw. Reckoning that the same quantity of material would be required as in the case of wheat-straw, namely three tons of straw for one ton of paper, it might be a grave question whether that article could be employed to advantage commercially. If the whole of the paper manufactured in this country were to be made of straw, it would not consume more than one-tenth of the straw annually produced. The same remark would apply to the fibre of the sugar-cane for paper-making purposes—namely, the cost of freight. With reference to the other fibrous materials available for the purpose, he would state that, at the time when the late Dr. Forbes Royle read his paper upon fibrous plants, he (Mr. Stones) took the list of those fibres to a colonial broker, who informed him that they were worth in the market, for rope and other manufactures, double the price that the best rags were fetching; consequently, he inferred that a large introduction of those materials would affect the hemp and flax market rather than that of paper material. Couch grass, or twitch, had been mentioned as a substance applicable to paper manufacture, but he thought the price spoken of, viz., 10s. to 12s. per ton, would hardly pay for the colleeting. From £20,000 to £30,000 had been expended in the endeavour to work up this material, but as it did not answer, the establishment was now engaged in working the ordinary paper materials. Mr. Simmonds had alluded to the circumstance that the small quantity of paper exported from this country was owing to the deficiency of material for the manufacture of low-priced papers. But there was another thing to be considered, that was the almost prohibitory duty which was levied upon paper in many countries. In Canada, our own colony, there was a duty of 12 per cent.; in the United States the duty, which was formerly 30 per cent., was now reduced to 24 per cent.; whilst in France there was a duty of 1s. per pound, or 200 per cent.; and yet to each and all of these places the English managed to send paper. So much valuable time and money had been wasted by ingenious persons since the premium for a new material for paper was advertised in the *Times*, that he felt called upon to caution those who were disposed to follow out the suggestion, that a great many articles had been tried and found wanting in a commercial point of view.

Mr. Battley mentioned that leather cuttings had been utilised in the manufacture of Prussian blue, whilst a great deal of the same description of refuse was employed in white lead works. Another application he could mention, as coming within his own experience, was in manufacturing from the better description of leather cuttings an inner sole for boots and shoes, which rendered those articles more comfortable to the wearer, and, at the same time, protected the foot from wet if the outer sole became worn away.

Mr. Varley said in three instances in particular, in which the utilisation of waste substances had been pointed out by Mr. Simmonds, he was induced to think that this utilisation was not legitimate. The first was in the case of re-working up woollen fabrics, the result of which was to destroy the fibre of the wool. Hence it was that when he purchased new stockings made partly of old wool mixed with a small quantity of new material, he found his feet went through them. The second case was that of glue, which was now made of very inferior quality, from the circumstance that every substance containing a particle of gelatine was forced into the service. Formerly glue was made of so good a quality that its adhesive powers were stronger than the fibre of the wood which it cemented together, and the wood would fracture before the glue, but this was not the case now. The third instance was in the case of paper, which, under the so-called system of utilisation, was worked up time after time, until it was reproduced in the shape of a worthless commodity for any purposes of durability; and hence a drawing which was worth a hundred guineas was sometimes placed on a piece of paper which had no lasting qualities.

Mr. F. B. Houghton was proceeding to read a paper descriptive of his process for converting flax refuse into half-stuff for paper-makers, but was stopped by the Chairman, as out of order in so doing. The paper was handed to the Secretary, and the process appears to be as follows:—

The flax refuse is boiled in an alkaline solution at 380° Fahrenheit, and, after being subject to the process for about three hours, is converted into excellent half-stuff, free from all trace of silica. The refuse employed is not merely that of the mills, but includes that which, having been threshed for the seed, is valueless for the manufacture of linen, and is generally thrown away. Thus at length, he considers, is overcome the difficulty of obtaining a raw, material cheaper and more plentiful than rags, and which, not being the remains of something that has already been used, can be profitably produced for the purpose of making paper.

It appears from Mr. Houghton's statement, that flax, straw, and flax refuse may be purchased for a few shillings per ton, and by this inexpensive process may be reduced into pulp, equal in quality to that produced from the best linen rags, which cannot be purchased under £28 to £30 per ton. The largest boiler he has at present in use, is one capable of containing about 3cwt. of raw material, from which 1½cwt. of half-stuff may be produced. The whole operation occupies about four hours. Difficulty was at first experienced in getting rid of the small particles of unreduced matter so constantly seen in ordinary straw paper, but this is an obstacle that Mr. Houghton states he has entirely overcome.

Mr. G. F. WILSON, F.R.S., said the recovery of grease from the soap waters of the woollen manufacturers, alluded to by Mr. Simmonds, though only recently very prominently talked about, had been for some years carried on in this country on a very large scale, and some millowners were now in the habit of extracting the grease for themselves. This manufacture afforded an instance of how waste products often required two distinct inventions before they were utilized. Macartan, in the specification of his patent of 1837, described a good practical process for separating the grease from the waters of the woollen mills; but it was not till some years afterwards that the introduction of the practical distillation of fatty bodies gave the power of purifying such grease sufficiently to make it worth collecting. The glue refuse, mentioned in the next paragraph, had a use besides that as manure, a grease being extracted from it, and some of the finest specimens of stearic acid in the Exhibition of 1851 had been made from this offensive material. He could confirm Mr. Simmonds's opinion of the value of the palm kernel oil trade; this kernel oil was now extracted largely, not only in Africa, but from imported nuts in this country; and that this was not done long ago was not the fault of the manufacturers here, as they frequently called attention to the large quantity of waste nuts, and the valuable oil they contained. This oil, when carefully prepared so as to keep its white colour, was worth more than the red oil of the pulp surrounding the nut, to obtain which the palm fruit was formerly exclusively collected. As confirming the Melbourne discovery of the dye extract from "B. flats," he might mention, that when lately picking off some brown aphides from peach buds, his fingers were dyed a bright brown where the insects had been squeezed. One of the waste products mentioned, glycerine, had been spoken of as a preservative of fish, and it might be useful in small quantities to cure fish for food; but his experience of its use in large quantities upon a large red lake trout which, by immediate coating with glycerine, he was enabled to bring from Scotland to London so unchanged as to preserve even the beautiful fugitive colour of the scales, went to show that immersion in concentrated glycerine, at least, would, by extracting its flavour, render fish so treated worthless as food. Dr. Lankester, when suggesting the publication of a list of waste substances wanting uses, perhaps, at the moment, forgot the long catalogue published in the last premium list issued by the Society.

Mr. HILTON begged to mention, in connection with this subject, that a friend of his had taken out a patent for the utilisation of wolfram; which was no sooner done than the parties who had the supply of that material, raised the price of it considerably; that had been the case in several instances with which he was acquainted, in which patentees had attempted to utilise waste products, and the moment they did so, a combination was entered into by the holders of the article, and the price of it was raised accordingly. Mr. Hyde Clarke, in his remarks upon the utilisation of the gases from smelting furnaces, &c., had placed sulphur at a low scale of value, with which he (Mr. Hilton) did not agree. When there was a prospect of war with Naples, sulphur rose rapidly in price, and it formed a principal element in the manufacture of that important article sulphuric acid.

The CHAIRMAN said the time having now arrived when it was his duty to ask the meeting to accord their thanks to Mr. Simmonds, for his very able and interesting paper, he might be permitted to offer one or two brief remarks upon this subject. In the first place he would say that the title of the paper was hardly appropriate to the subjects treated of. He thought it should have been "the utilisation of substances which have been in times past waste substances." There were several of these substances to which allusion had been made. In the first place, there was the sewage manure. He agreed with Dr. Lankester, that in the large towns where so much water was used, they could not do much in the way of utilising the sewage; but in passing through the country districts, they must have been struck with the amazing quantity of animal and vegetable matter that was wasted in every farmyard. He believed all they had to do was to direct attention to these facts, which was best done in such papers as this, as they were very widely circulated by means of the *Journal*, and without it they would be unknown beyond the limits of that room. Then, again, as to coal. At present many of the products of coal were wasted, and this they must look to the chemist to remedy. One great fact connected with the use of coal was the bad construction both of furnaces and private fire-places; waste was thereby promoted in every possible form, as was best shown by the immense volumes of smoke that filled the atmosphere of every large city. Then, again, there was another formerly waste product which was now utilised, and from which articles of great commercial importance were derived. One portion of refuse from the manufacture of soap was iodine; another was glycerine; and there were other equally important products both in the soap and candle manufacture. They had been told by one speaker that they were retrograding in one or two points in attempting to utilise these waste substances. He had complained that on putting on a new pair of woollen stockings for the first time his foot went through them. He was afraid the answer to that was to be found in the place at which the articles were bought, and the price paid for them. If persons would have cheap commodities when they were unable to judge whether they were cheap and good or cheap and bad, they must be content to pay the penalty. The same argument applied to glue and to paper. If good qualities of those articles were required, he believed they were always to be obtained by paying a proper price for them. He would now call upon the meeting to pass a vote of thanks to Mr. Simmonds, and he would express a hope that, on a future occasion, he would find an opportunity of treating one or two of the more important subjects introduced that evening in a more detailed manner.

The vote of thanks having been passed,

Mr. SIMMONDS in acknowledging the compliment, said in justice to himself he must state that owing to the extent of the subject, he had been compelled to omit in the reading of the paper, matters which would be found more in detail in it when published in the *Journal*. With regard to the title of the paper, he admitted its inappropriateness, but the difficulty was to select a proper one. It had been argued by one speaker that he had introduced articles which could not be made use of, owing to their bulk and the cost of transmission to this country; but he had thrown out the suggestion that such material might be imported in the shape of half-stuff, and not as entirely raw material. He had not gone into the question of adulteration or sophistication; that was not a matter with which it was his province to deal. It was for buyers and those interested to look out for the protection of their own interests. If people would purchase cheap things, they must take the consequences.

The Paper was fully illustrated by curious and interesting specimens of all the leading articles referred to, from Mr. Simmonds's private collection. Mr. C. Nightingale also contributed illustrations of flocks for stuffing and other applications of waste wools, and the refuse feather dust from the drying mill, used as manure; Mr. S. Mahood sent some elegant fish-scale ornaments; Mr. M. C. Cooke, paper made of various materials; Messrs. G. Thomas and Son, flock and flock papers; and Mr. J. B. Balcombe, Secretary of the Agricultural Chemical Company, samples of their new patent fish manure.

The Secretary announced that the Paper for Wednesday evening next, the 16th instant, would be "On the Society of Arts Union of Institutes, and the Examinations connected therewith," by Mr. Harry Chester, Vice-President, late Assistant-Secretary to the Committee of Privy Council on Education. On this evening the Lord Bishop of London, President of the Crosby-hall Evening Classes, will preside.

The following letter has been received by the Secretary since the meeting:—

Sir,—With reference to the subject of Mr. Simmonds's paper, I have seen with regret that the gardeners and horticulturists waste their flowers, which by a proper application of known principles could be economised. Flowering plants are cultivated, but they do not always find a market. Now, it is a real waste not to utilise the blossoms which

"Waste their fragrance in the desert air."

It is not in England alone that this occurs, but in her colonies. In Jamaica, in St. Helena, and many other places, orange blossoms and jasmin flowers are in abundance, but no effort is made to save or economise their fragrance, although the ottos procurable from them are nearly as valuable as gold, weight for weight, and for these England pays pretty dearly to France and Italy. There is a steady and regularly increasing demand for the odorous principle of flowers by the perfumery factors of England. Why then do not some of the British colonies supply this demand?

Passing to another waste substance, I think the English farmers cannot be aware of what an excellent guano there is to be had for nothing at the port of London. When the tide is down, there is found a rich deposit on the banks of the Thames, which no one seems to take an interest in, except "the mud-larks." If a few of the farmers would charter a canal boat and fetch this mud—which offends both Lords and Commons—they would find that they could procure a manure, equal in monetary value to £5 per ton, for 30s. The numerous canals, and even the river itself, are good "highways" for carrying this to the corn fields, and London would be glad to pay something to remove it, as it does now in the "rate for cleansing and sweeping."

The most important subject, however, which can be discussed relating to waste is that of waste lands within a short distance of this metropolis, for although an Act of Parliament is especially necessary for its inhabitants to obtain only one hundred superficial feet of space out of its back windows, there are hundreds of acres of waste land near it, of which no use is made. That this land—bearing the familiar names of Putney Heath, Boxmoor, Chobham, Aldershot, &c.—should not be "utilized," does appear a paradox to the proverbial industry and economy of Great Britain; and the sooner these "wastes" are made useful the happier will her children be.

I am, &c.,

SEPTIMUS PIESSE.

Bond-street, W.

THE NATIONAL GALLERY AND THE ROYAL ACADEMY.

The Chancellor of the Exchequer informed the House of Commons on Tuesday evening, that an arrangement had been come to between the Government and the Royal Academy, to the effect that the latter body would give up to the Government the portion of the National Gallery hitherto occupied by the Academy, the Government furnishing them with a site on the grounds at Burlington House, on which the Academy would out of their own funds erect a suitable building for themselves. The whole of the National Gallery will then become available for the national pictures; and fitting accommodation will be there found for the Vernon and Turner Galleries. In the meantime, until the new building for the Royal Academy is completed, which it is expected will take about two years, the Vernon and Turner collection will be placed in a temporary building, to be erected on that portion of the Royal Commissioners' land, at Kensington, which is now leased to the Government.

INDUS STEAM FLOTILLA.

The first vessel of a series which is destined and expressly constructed for the river traffic of the Indus, between Hyderabad and Mooltan, was tried down the river on Monday last, the 7th instant, in the presence of a numerous party of scientific gentlemen and some of the directors of the Scinde and Punjaub Railways, to whose enterprise it is due that steamers really fitted for Indian river navigation are at length being adopted.

The difficulties which have hitherto lain in the way of keeping up continuous communication along the waterways of the Indian empire during the dry season, have been chiefly, if not entirely, mechanical ones. Steamboats for such service, indeed, require the most perfect reconcilement of what at first sight appear to be almost impossible conditions, such as great power, high speed, and ample stowage for cargo, with less that two feet draught of water. The directors, therefore, of the new flotilla company wanted a vessel combining in the best way it could, the many opposite qualities required for the navigation of the river. The engineer of the company, Mr. Yarrow, being aware of the peculiar nature of the difficulties to be overcome, and having obtained all the information which the limited experience of the Indus navigation would yield, decided that it was necessary that the steam flotilla for such a traffic should be composed of vessels able to pass all bars and shallows by only drawing two feet of water, and that they must further have a speed of twelve miles an hour; be 200 feet long and 38 feet wide, in order to convey the goods and passengers, and, above all, that they must be of sufficient power to be able to tow barges and river-boats up the stream with them. Plans and specifications of the requisites were accordingly prepared, and the company invited the competition of engineers and ship-builders. Of all the designs sent in, Mr. Scott Russell's was selected, and he was accordingly directed to construct the first vessel of the flotilla, to test by experience how far the mechanical difficulties in its structure could be overcome. This vessel was, on Monday, for the first time, tried down the Thames, and the result of the trip was in the highest degree satisfactory, surpassing even the expectations which had been formed as to speed, power, &c. The boat, in appearance, is very like the American river-steamers—flat-bottomed, square-shaped, and with a deck-house which almost covers the entire vessel. Her length over all is 220 feet, breadth 38, draught of water 1 foot 10 inches. As a passenger boat, and with average cargo, her speed is equal to a little over 13 miles an hour, and with boats containing 500 tons cargo in tow, it is confidently reported that she can be depended on to average eight miles an hour on the Indus. The hull is constructed in a peculiar manner, in order to carry the weight, and sustain the propelling power of large machinery.

Two longitudinal wrought-iron girders run the whole length of the vessel, rising some feet above the deck, so as to form the walls of the deck cabins. The girders form the main strength of the hull, and are applied in a manner specially designed by Mr. Scott Russell, and which he has already employed in the construction of the Great Eastern and other vessels where great strength and great length are necessary. The engines of the vessel are, nominally, of 120-horse power, but capable of working up to 600 indicated horse power. They are three-cylinder oscillating engines, the merit of them being due to Mr. Scott Russell, and they bid fair to come into very general use, whether for paddle or screw engines.

During the whole of the trial, though these engines sometimes exerted their full power against a head-wind and strong tide, they worked with the most perfect ease, and with very little of that vibration generally produced in vessels of large power and light draught of water. Mr. Scott Russell undertook that the draught of water, when laden with passengers, and an average cargo of 350 tons, should not exceed two feet. On Monday, however, her draught was, aft one foot ten inches, and forward scarcely twenty inches.

The satisfactory nature of the principles on which she has been constructed was considered as conclusively proved, and a greater thickness and strength of hull will be allowed to the other vessels of the flotilla, which will shortly be constructed and despatched to India as soon as finished.

Home Correspondence.

ELECTRO-ZINC DEPOSITS ON ENGRAVED COPPER PLATES.

SIR,—Your last number contains a letter from Mr. Henry Bradbury, describing a process for covering an engraved copper-plate with a deposit of zinc, in order to protect it from wear while being printed, and it is stated such a deposit will yield from 1,500 to 2,000 impressions.

This is an imitation of the process for covering engraved copper-plates with iron before sending them to press, originally introduced in Paris under the name of "Acierage," for which I hold an English patent, taken out last year, and which process I had the honour of describing before a full meeting of the Society of Arts, in a paper read on the 24th of November last.

It is a well-known fact that zinc, in a pure state, is even softer than copper, and, moreover, it has a natural tendency to retain the printing ink instead of giving it off freely, as steel and its basis, iron, will do. Every printer who has had zinc plates to work from can testify to the very limited number of good impressions which are obtainable from zinc plates, sometimes used for maps, plans, &c.; whereas the metal I use, as described in the specifications of my patent, is capable of yielding 10,000 impressions and upwards before the first coating shows signs of wear. This was exemplified at the last meeting of the Graphic Society, where I exhibited several engraved copper plates, forming part of a work shortly to be published, some of which had already produced 10,000 impressions, and this with one coating, without any perceptible difference between the first and the last impressions which I had sent with the plates.

Such a result will, I hope, establish in a satisfactory manner the superiority of the one metal over the other; for zinc cannot by any possibility compete with the harder metal—iron, which seems to acquire, by being deposited through galvanic agency, a power of cohesion and resistance much beyond that which pure iron possesses, and very nearly equal, for printing purposes, to the best steel used in the trade for making steel plates.

I am, &c.,
F. JOUBERT.

Porchester-terrace, Feb. 10, 1859.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Rev. Henry Christmas, "On Shakespeare's Historical Dramas."
Medical, 8.
Geographical, 8½. I. Mr. J. W. Taylor, "On the Aurora Borealis in Greenland." II. "Discovery by Capt. Palliser and Dr. Hector of Practicable Passes through the Rocky Mountains, within the British Possessions, &c.," communicated by the Right Hon. Sir E. B. Lytton, H.M. Sec. for the Colonies.
TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Statistical, 8.
Pathological, 8.
Civil Engineers, 8. Discussion on Mr. Jameson's Paper "On the Performances of the screw steam-ship *Sahel*, fitted with Du Tremblay's Combined Vapour Engine, and of the sister-ship *Oasis*, with Steam Engines worked expansively, and provided with Partial Surface Condensation."
WED. ......United Service Inst., 3. Mr. F. A. Abel, "On Gunpowder: its Nature and Effects as compared with those of other Explosive Bodies, its Composition and Decomposition."
London Inst., 7. Conversazione.
Royal Soc. Lit., 4½.
Society of Arts, 8. Mr. Harry Chester, "On the Society of Arts' Union of Institutions, and the Examinations connected therewith."
Microscopical, 8. Anniversary.
Entomological, 8½.
THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Royal Soc. Club, 6.
Antiquaries, 8.
Linnean, 8. I. Professor Huxley, "On the Structure of the Integument in the *Crocodilia*." II. Mr. Macdonald, "On the Anatomical Characters of a remarkable form of Compound *Tunicata*." III. Mr. Macdonald, "On the Anatomical Characters of an Australian species of *Perophora*." IV. Mr. Walker, "On *Heterocerous Lepidoptera*," collected by Mr. Wallace at Singapore.
Chemical, 8.
Royal, 8½.
FRI.........Geological, 1. Annual General Meeting.
United Service Inst., 3. Rev. Dr. Wolff, "On the Spirit of Mohamedanism and Mohamedans in Egypt, Arabia, Persia, Bokhara, and Affghanistan, with reference to the present War in India."
Royal Inst., 8½. Dr. S. Scott Alison, "On Certain Auditory Phenomena."
SAT. ......Asiatic, 2.
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered during the Vacation 1858.

415. Colonization and Settlement (India)—3rd Report.
479. Quartermasters—Copy of Memorial, &c.
485. Colonels—Return.
493. Gold and Silver Watch Cases—Return.
494. East India—Return.
502. Suspended Canonries—Return.
466. Revenue (Ireland) Accounts.
482. Consular Service and Appointments—Report.
526. Skerries Harbour—Return (a corrected Copy).
444. Public Establishments (Exemption from Rates)—Report.
475. Kafir War—Account.
496: Curragh and Aldershot Camps.—Return.
503. Fines and Penalties (Ireland)—Abstract of Accounts.
514. Municipal Boroughs (Ireland)—Abstract of Statement.
476. Standing Orders of the House of Commons.
504. National Gallery—Correspondence.
71 (1). East India (Missionaries), East India (Idolatry)—Return.
462. Sugar, &c.—Return.
470. Fines and Penalties (Ireland)—Return.
98 (A v). Poor Rates and Population—Return (A).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February* 4, 1859.]

Dated 2nd November, 1858.

2438. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved system of railway brakes. (A com.)

Dated 1st December, 1858.

2740. R. Laming, Hayward's-heath, Sussex—Imp. in purifying gas, and in turning sulphuretted hydrogen, carbonic acid, and ammonia, or their compounds, to profitable account.

Dated 27th December, 1858.

2962. F. W. Turner, Foxhole Colliery, Swansea—Imp. in steam engines, condensers, and steam boilers, and in promoting combustion in the furnaces of the same.

Dated 28th December, 1858.

2968. A. Lyons, Finsbury—Imp. in travelling bags.

Dated 1st January, 1859.

8. J. Walkland, Green-lane, Sheffield—An apparatus for lighting cigars and tobacco.
18. I. Wood, Charing-cross—Imp. in cutting and finishing corks, and in machinery used for such purposes. (A com.)

Dated 13th January, 1859.

106. W. Bennetts, Tuckingmill, Cornwall—Imp. in mechanism used for preventing accidents when raising or lowering skips, baskets, or apparatus, particularly applicable to mines.
117. W. Wilson, Newcastle-on-Tyne—Imp. in machinery for felting bodies of hats and bonnets. (A com.)

Dated 15th January, 1859.

128. J. Eccles, Blackburn, Lancashire—Imp. in the manufacture of articles from clay earths for building purposes, as substitutes for such articles as are usually formed of stone and other materials.
130. P. A. Viette, 25, Faubourg de Schaerbeck, near Brussels—Certain inks applicable for engraving and lithographic purposes.
132. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of cast steel.
134. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.

Dated 17th January, 1859.

136. T. Edwards, Liverpool—Imp. applicable to letter boxes and other like receptacles.
138. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for sowing seed. (A com.)
140. S. T. Cooper, Upper Clapton—Imp. in the use and application of artificial light.
142. E. Brooks, 43, Edward-street, Dorset-square—Imp. in locks.
144. G. Collier and J. Collier, Halifax—Imp. in means or apparatus for washing and drying wool and other fibres, part of which improvements is also applicable for other purposes, where steam, hot air, or other fluids are required to be conveyed under pressure through moveable connections.

Dated 18th January, 1859.

146. J. Luis, 1B, Welbeck-street, Cavendish-square—A new machine for putting on, equalizing, and drying the colours on paper for hangings, book-binding, boarding, and fancy paper of every description. (A com.)
147. W. Newman, Aston, near Birmingham—New or improved furniture for window and other blinds.
148. J. Foster, Lancaster—Certain imp. in machinery or apparatus called "spinning frames" and "roving frames" employed for spinning and roving flax, tow, hemp, jute, and other fibrous substances.
149. G. Hamilton, Liverpool—Imp. in treating rosin and resinous substances to obtain products therefrom, and in treating the products obtained from rosin and resinous substances.
150. H. Gallon, J. H. Bean, and S. Lumb, Leeds—Imp. in machinery for slotting, morticeing, tenoning, and cutting wood, iron, and other substances.
151. C. D. Archibald, Rusland-hall, Lancashire—Generating force. (A com.)
152. R. A. Brooman, 166, Fleet-street—An improved silk thread, and a new fabric made entirely or partially from the same. (A com.)
153. R. Garrett, jun., and J. Kerridge, Leiston Works, Saxmundham, Suffolk—An improved arrangement of combined thrashing and dressing machine.
154. J. Fawcett, Kingston-upon-Hull—An improved preparation of food for cattle and horses.
155. R. Bradley and W. Craven, Westgate Common Foundry, Wakefield—Imp. in machinery or apparatus for manufacturing bricks, tiles, and other similar articles.
156. W. Trotter, South Acomb, Northumberland—Imp. in reaping machines.
157. J. H. Johnson, 27, Lincoln's-inn-fields—Imp. in air pistols and guns. (A com.)

Dated 19th January, 1859.

159. W. A. F. Powell, Bristol—Imp. in stopping or closing jars and bottles.
161. T. Clarke, Litchurch-lane, near Derby—Imp. in the manufacture of core barrels for piles or columns used either for railway piles or columns, or for water pipes, or sewerage pipes.
162. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for measuring and sorting silk and other textile materials. (A com.)
163. J. Whitehead, Halifax—Imp. in the means or machinery for the manufacture of purled wire.
164. E. Stevens, 5, Patriot-row, Cambridge-road—An improved cooking utensil.
165. T. A. Evans, 15, Queen's-road, Bayswater, and W. J. H. Rodd, 38, Arlington-square, Islington—A new method of advertising.
166. W. Poupard, Blackfriars-road—An improved wheel-skid or shoe.
167. J. H. Johnson, 47, Lincoln's-inn-fields—Certain imp. in the manufacture or production of lasts, boot-trees, and clogs, and in the machinery and apparatus employed in the production of such articles. (A com.)

Dated 20th January, 1859.

170. J. C. Reid and W. Milner, Liverpool—Certain imp. in the construction of ships and vessels.
171. H. Hilliard and T. Chapman, Glasgow—Imp. in table knives, and in table-knife sharpeners.
172. A. Lindo, Batignolles, France—Imp. in manufacturing soap.
173. W. Woofe, Gloucester—Imp. in implements for ploughing, tilling, and paring land.
174. E. T. Hughes, 123, Chancery-lane—Imp. for preventing incrustation in steam boilers or other vessels.
176. S. Phillips, Moseley, Worcestershire—Imp. in sliding sashes, shutters, or doors.
177. W. E. Newton, 66, Chancery-lane—Improved apparatus for measuring water and other liquids. (A com.)
178. T. Greenwood, J. Batley, and J. Dockray, Leeds—Improved machinery for converting hemp and flax fibres into yarn, twine, ropes, and cordage.
179. J. Bent, Newhall-street, Birmingham—Certain imp. in clasps or fastenings applicable for belts, garters, and other purposes.
180. J. Shanks, Arbroath, N.B.—Imp. in mowing machines.
181. J. L. Clark, Haverstock-hill, and J. Muirhead, Gloucester-road, Regent's-park—Imp. in electric telegraphs, and in the apparatus used in working the same.
182. H. Sagar, Broughton, near Manchester, and A. Schultz, Paris—Imp. in producing pink shades on cotton fabrics or yarns.

Dated 21st January, 1859.

183. T. Richardson, 20, New Bridge-street, Newcastle-on-Tyne—Imp. in the manufacture of manure.
184. S. Osler, Great Yarmouth, Norfolk, and J. B. Balcombe, Brixton, Surrey—Imp. in apparatus for treating fish, so as to adapt it for manure, and in using the same alone or in combination with superphosphate of lime or other phosphates.
185. L. Le Prince, 261, Regent-street—The imp. of ladies' boots and shoes, called the cameleon boot and the cameleon shoe.
186. G. B. Harkes, 1, Montague-terrace, Trinity-square, Southwark—An improved machine for washing, wringing, and mangling.
187. G. Ellis, 4, Collier-street, Pentonville—The imp. of muffs, to be called the patent reticule muff.
188. J. Hick and W. Hargreaves, Bolton-le-Moors, Lancashire—Imp. in the construction of steam boilers.
189. R. Howell, Smethwick, Staffordshire, and R. J. Willder, Birmingham—An imp. or imps. in taps or stop cocks.
191. W. Wells, Greenland, near Halifax—Imp. in machinery or apparatus employed in spinning and twisting cotton, and other fibrous substances.
192. A. Davenport, Birmingham—An improved regulating burner for gas. (A com.)
193. J. Childs, Windsor-house, Windsor-road, Putney—An imp. in applying heat in the manufacture of artificial gums and teeth, and other articles composed of india-rubber, or gutta-percha, combined with sulphur.
194. J. H. Hume, Broughty Ferry, Forfar, N.B.—Imp. in warming apparatus for the feet.
195. A. J. A. Gautier, J. G. Dumay, and J. T. Persin, Paris—An improved manure.
197. J. Newman, Birmingham—Imp. in the manufacture of chains.
198. B. Lauth, Surrey-street, Westminster—An improved mode of, and improved machinery for, rolling plates, bars, rods, and shafts.
199. J. Edwards, 77, Aldermanbury—Imp. in the manufacture of buckles.

Dated 22nd January, 1859.

201. D. Moseley, Chapel Field Works, Ardwick, Manchester—Imp. in the manufacture of india-rubber thread.
203. E. Dorsett, 76, Old Broad-street, London, and J. B. Blythe, Minerva-place, New-cross, Kent—Imp. in the distillation of oil from coal tar, and in apparatus for preserving timber therewith.
205. W. E. Newton, 66, Chancery-lane—Improved machinery for cutting files. (A com.)
237. C. Sharps, Philadelphia, Pennsylvania, U.S.—Imp. in breech-loading repeating fire arms.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Feb.* 4, 1859.]

February 4th.

1781. E. Leigh.
1788. A. V. Newton.
1791. G. H. Bovill.
1797. J. Walker.
1804. J. Walker.
1818. A. Barchou.
1821. F. Haeck.
1835. J. H. M. Maissiat.
1864. L. A. Forot.
1958. F. Massey.
2195. H. Monier.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, Feb.* 4, 1858.]

January 31st.

273. E. Schischkar.
279. A. Lamb and J. Ronalds.
419. C. S. Jackson.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 18, 1859.

EXHIBITION OF 1861.

The following letter has been addressed by Sir Cusack P. Roney to the Chairman of Council:—

London, Feb. 16, 1859.

Sir,—Referring to our recent conversation on the subject of the Exhibition of 1861, I desire to convey to you, by letter, my conviction that it cannot fail to attract a number of foreigners to this country, who would not have thought of coming here in 1851.

Whatever the statistics of the past may show, they are, in my mind, almost valueless as affording indications of what may be done if a large and comprehensive system for attracting visitors to us from all parts of the world, in 1861, be carried into effect.

I will give you my reasons.

Since 1851 various railways on the Continent, converging more or less towards this country, have been opened, and several others of great importance, both in respect of shortening existing routes and of opening new districts, will be completed this and next year.

Besides, the continental railways have now learned to appreciate through-booking, return-tickets, and excursion traffic at reduced rates, which they would not look at a few years back.

I have the proof of this within my personal knowledge. I was engaged last year, when it was understood that the *Great Eastern* was to run to Portland, in the United States, to make arrangements for through, return and excursion-tickets for the passengers by her. The system was to extend not only through the United Kingdom, but also through France, Switzerland, Germany, and Belgium. In no case was there any difficulty interposed by the numerous railway companies with which I communicated, and considerable facilities and reductions were offered by some of them. Therefore, what was agreed to in the case of this ship would, beyond all doubt, be approved on the more extensive system.

The case of our own railways affords abundant proof of travelling development since 1851. The total number of passengers conveyed on them that year was 85 millions; in 1857 there were about 140 millions; and these numbers are constantly on the increase, at a rate of proportion immensely beyond the additional mileage opened each year.

You can now travel from London to Aberdeen, a distance of nearly 600 miles, in 16 hours; and you can go by railway as far north as Inverness. In 1851 the railways did not extend beyond Edinburgh and Glasgow; and it required 17 hours to reach these places from London.

Owing to the expected completion of the new railway now constructing between London and Dover, and to the opening of sections by which two or three of the *détours* now existing between Calais and Paris will be cut off, the short sea-passage journey between the capitals of France and England will, in the autumn of next year, be effected in ten hours, and at a cost, for a first-class passenger, nearly £1 less than at present.

In 1861 the communication between London and Dublin will be completed twice a day each way, in eleven hours and a quarter, under penalties of £1 12s. a minute for all avoidable delays beyond that time, and at fares about 30 per cent. cheaper than they were in 1851. At that time the railway system was only beginning to be developed in Ireland. By the end of next year, it will be extended almost to its furthest western, northern, and southern limits.

As respects the American continent, the number of persons who come to Europe every year is largely on the increase, especially in steamers. In 1851 there were not more than 75 steam passages from America to Europe. Yet, in last year, with all its commercial depression, there were upwards of 150. During this year there will be nearly 250 (the fares, *at least*, 30 per cent. cheaper than in 1851), and I have not the smallest doubt that there will be, on the average of 1861, a first-class steamer leaving Europe for the United States or Canada, and a similar steamer leaving Canada or the United States for Europe, six times a week. In the summer months there will be an excess of this quantity; in winter below it.

Now there are complete railway systems extending from New York, Boston, Portland and Quebec, the ports for the Atlantic steamers, as far west as the Missisippi, and beyond it. In 1851 they did not extend beyond a third of this distance from New York or Boston, and there was no railway from either Portland or Quebec.

London is at present only 30 to 35 days from our chief cities of India, and there is now a weekly communication. In 1851 it was monthly, in about 45 days. Australia is about 50 days as compared with 100 in 1851. By the advances in steam navigation, the passages to and from our West Indian colonies have been diminished by nearly a third of what they were in 1851. We now have well-organised steam communication to South America, which did not exist in 1851. The same as regards our African colonies.

In short, look to what part of the world we may, we see increased facilities of communication. Every one of these tends towards England, and of necessity towards its great metropolis. I therefore think that as regards facilities, without saying a word on the increased desire of every one for travel, or on the reduction of fares which has taken place almost universally, sufficient has been said to prove that the statistics of the past cannot form a real criterion as to what may be expected if the Exhibition of 1861 have in it—as I believe it can have—features every whit as attractive as, though differing in many respects from, its great predecessor of 1851.

Let me suggest that the traffic arrangements for this Exhibition be begun in ample time. Minute, varied, as well as complicated internal organization will be necessary, so that everything may be clear, simple, and explicit as regards the public. Coupled with this business must be a good system of lodging arrangements for the accommodation of the strangers whilst they are in London. But your own experience on this matter renders it unnecessary for me to do more than refer to it.

Believe me,
Yours faithfully,
C. P. RONEY.

C. Wentworth Dilke, Esq., Chairman of the
Council of the Society of Arts.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Bradford, Yorkshire.

Rev. W. R. Smith, M.A., Hanover-square, Bradford, *Chairman.*
Mr. John Henry Bell, M.R.C.S., Westgate, Bradford.
Rev. J. R. Campbell, M.A., Horton-road, Bradford.
Mr. Thos. Clark, Trafalgar-street, Bradford.
Rev. H. B. Creak, M.A., Manningham, Bradford.
Mr. J. D. Crebbin, Chapel-street, Bradford.
Rev. D. Fraser, LL.D., Principal of Airedale College, Bradford.
Rev. S. G. Green, B.A., Shipley, Bradford.
Mr. Wm. Guy, Marborough-road, Bradford.

Mr. James Hanson, 51, Hanover-square, Bradford.
Mr. J. M. Jaques, Trafalgar-street, Bradford.
Mr. Edward Kenion, Oak-lane, Manningham, Bradford.
Mr. James Law, Claremont, Bradford.
Mr. Chas. Lund, Northfield-place, Manningham, Bradford.
Mr. T. J. Newboult, Borough-rate Collector, Bradford.
Rev. J. H. Ryland, Cliffe-villas, Manningham, Bradford, President of the Mechanics' Institute.
Mr. A. Smith, 3, Sawrey-place, Bradford.
Mr. Samuel Smith, 23, Bedford-street, Bradford.
Mr. M. H. Walls, 66, Victoria-street, Bradford, *Secretary.*

The Preliminary Examination by this Board is fixed for Thursday, March 31st.

For the London Domestic Mission.

Rev. John Browne, 30, Linton-street, New North-road.
Mr. F. W. Gibson, 25, Haverstock-hill.
Mr. J. M. Wade, 45, Lincoln's-inn-fields, *Secretary.*

For Waterford.

Mr. H. Baschet.
Mr. David Keogh.
Mr. J. C. Walshe.
Mr. P. D. Walshe.
Rev. J. Wilshire.

ELEVENTH ORDINARY MEETING.

Wednesday, Feb. 16, 1859.

The Eleventh Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 16th inst., the Lord Bishop of London in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Chisholm, John	Langley, John Newton
Dawson, Charles, F.R.S.	Reynolds, Samuel Wm.

The Paper read was—

ON THE SOCIETY OF ARTS' UNION OF INSTITUTES, AND THE EXAMINATIONS CONNECTED THEREWITH.

By Harry Chester, V.P., late Assistant-Secretary of the Committee of Council on Education.

The Society's "Union of Institutes" was one of the results of the Great Exhibition of 1851.

Originated by this Society, and consummated by the Royal Commission, with general applause, that grand international inquest into the life and manners of the industry of the world was designed to promote the interests of "Arts, Manufactures, and Commerce;" but, being by design an Exhibition of the results of the industry of all nations, it could not fail to be in effect an exhibition of the results of their industrial instruction and education; and, among the many valuable lessons which we learned in Hyde-park, in that memorable year, there was none more logically drawn from a comparative view of the British and foreign contents of the palace than this, that, if our arts, manufactures, and commerce were to be maintained in prosperity, the education of our countrymen must be effectually improved by instruction in art, and in science, as well as in literature and religion.

The acceptance of this lesson was immediately seen in a multiplicity of proposals of new schemes and new institutions for industrial instruction. Almost all of these proposals ignored the institutions that already existed having similar aims, or condemned them as hopeless failures. There were, however, already in action, in nearly all of the towns ,and in many large villages, a great number of Mechanics' Institutes, Athenæums, Lyceums, and other similar bodies, essentially popular in their origin, objects, and management, which had been established by the people themselves, and professed to instruct the people in literature, science, and art; and it was but reasonable that an attempt should be made to ascertain whether it was really necessary that new creations should supersede those institutions, or whether they might not be so strengthened and improved as to play at least a useful part in the great advance that was to be made in their own proper work, the industrial instruction of the industrial classes.

The Institutes were too generally feeble, it is true; but was it not possible to strengthen them ? They were generally isolated; but might they not be advantageously combined? They had no connexion with the great central associations which, under national auspices, were pursuing the objects of literature, science, and art; but was this defect incurable ? Might not the Institutes be made more practical in their aims ? and, without ceasing to furnish amusement, might they not become useful places for the systematic instruction of adults?

Questions such as these were proposed, in Nov. 1851, to the Council of this Society, by the President of a Literary and Scientific Institution, who, not himself at that time a member of the Society of Arts, had conceived that it might form the nucleus of a General Union of Institutes. The Council entertained the proposals, so far as to refer them by circular letters to the consideration of the Institutes; and the result was the creation of the Union on the 18th of May, 1852.

The Union at present comprises, in England and Wales 295 Institutions and 3 Chambers of Commerce; in Scotland 10 Institutions; in Ireland 4; in the Colonies 14; total, 326 Institutions. In addition to these there are between 60 and 70 "Local Boards," of which I shall speak by and bye. The returns of these Boards are not complete, but they will probably amount, when the Examinations are held in May next, to between 70 and 80. Some which I have counted as single Institutions are, in fact, large Unions of Institutions, ramifying throughout counties, and penetrating into the smallest villages.

Towards defraying the expenses of the Union, each Institute is charged with a member's subscription, two guineas a-year, to the Society. This payment may be made either by the Institute or by its President. In the latter case the President, besides bringing his Institute into the Union, without further payment, becomes himself a Member of the Society of Arts. There are also liberal arrangements by which very small Institutes, classes for the instruction of adults, libraries, and even isolated students, in villages, derive advantages from the Union.

Here then is a novel Association: a Metropolitan Society in close alliance and co-operation with a large number of kindred, but independent, Societies established in all parts of the kingdom. We ought to see considerable results; but, in estimating them, we must bear in mind a principle of essential importance. The object of the alliance was, not that the Society should govern the Institutes, or impose its own views upon them, or reform them after some uniform model, but rather, that the Society should give to them such aid as might develope the natural growth of their own internal life, and stimulate and supplement —not supersede—their efforts at self-improvement.

By annual and other Conferences between the Society and Representatives of the Institutes, by our weekly *Journal*, and by constant correspondence, the experience and information of the Society and of the individual Institutes are rendered available to all of them.

A very large number of them have agreed to an interchange of privileges; *i.e.*, a member of an Institute, being temporarily in the neighbourhood of another Institute, may obtain at that other, without payment, the privileges of membership.

This Society invites to its own Exhibitions and Meetings the members of the Institutes in the Union.

The Society, from time to time, prepares and supplies to the Institutes a detailed Register of Lecturers, paid and unpaid, their subjects, terms, and all other particulars. Books of all kinds, maps, and philosophical apparatus are obtained by the Institutes through the Society, at greatly reduced prices.

The Society circulates, on loan, for Exhibition, collections of specimens of photography, nature printing, chromo-lithography, and other articles: and several of the Institutes have agreed to interchange specimens of natural history, of manufactures, &c., for their Museums.

In 1854, the Literary and Scientific Institutions Act,[*] 17th and 18th of Vict. cap. 112, was obtained at the instance of the Society of Arts. This Act is, in fact, a Charter for Mechanics' Institutes and other similar bodies. Its provisions, little known, but of great importance, apply to "every Institution for the promotion of science, literature, the fine arts, adult instruction, useful knowledge, libraries, reading rooms, museums and galleries of works of art, collections of natural history, mechanical and philosophical inventions, instruments, or designs."

Long ago the School Sites Acts had created peculiar facilities for the procuring and settling of sites for elementary and normal schools; but nothing of the kind had been done for Institutes until the Act of 1854 was obtained. It extends to Institutes all, and more than all, of those facilities which had previously been given by the School Sites Acts to schools.

Any interest of any kind in any quantity of land not exceeding one acre, whether built on or not, may now be conveyed by a simple and inexpensive form to trustees for any one or more of the purposes to which the Act is applicable.

The conveyance may be either to individual trustees—in which case a simple and inexpensive mode of renewing the trustees is made available—or, which is much better, to corporate trustees, in which case the trusteeship or legal estate is perpetually sustained without the execution of any further deeds or any other proceedings whatever. The property is vested in the governing body of the Institution for the time being. Powers are given to sue and be sued in the name of an officer; to make and enforce bye-laws; to recover subscriptions in arrear, and the value of property injured or detained contrary to the rules; to proceed against purloining or embezzling members as against strangers; and (subject to certain provisions for appeal) to vary the objects of the Institutions. Those who are best acquainted with the Institutes, are best able to appreciate these enactments.

In another matter of legislation the Society has been less successful. At the request of the Institutes the Council has made several attempts to procure an amendment of the Act of 6 and 7 Vict., cap. 36, which professes to exempt Literary and Scientific Institutions from the payment of local rates. Discontent and litigation have been occasioned by the uncertainty and inequality of the law; and the Institutes have urgently demanded its amendment. The more, however, the subject of this law has been discussed, the less Parliament has shown a disposition to extend the principle of exemption. In 1857, Mr. Hutt's proposal to amend the act was summarily rejected by a large majority; and, in 1858, a committee strongly recommended that all exemptions should be discontinued, except those in favour of royal palaces occupied by her Majesty, places of public worship, burial-grounds, turnpikes, parochial roads, and public bridges. If any exemptions whatever are continued, except those in respect of her Majesty's residences, the Institutions will think it hard that the privilege, uncertain as it has been, which they have enjoyed, should now be withdrawn. If the legislature is desirous to benefit our Institutes, let the abominable nine-lived duties on paper be at once abolished; let the evening classes for the instruction of adults at Institutes have the option of being treated as favourably as the evening classes at the elementary schools under inspection; let the public service be more freely opened to the candidates who are successful in our Examinations; let the legislative electoral franchise be extended to all the holders of certificates from the Board of Examiners; and, if you will, let powers be given to the ratepayers everywhere to tax themselves, if they think fit, for the support of their own Institutes and Local Boards, or for substantial additions to the honorary rewards.

Our Society is too often supposed to be merely a Society for the promotion of the fine arts. It is, as you know, a Society "for the Encouragement of Arts, Manufactures, and Commerce," the term "arts" including both the fine and the industrial arts. The Society always entertained the idea that theory and practice must be combined to produce useful inventions; and that all improvement in arts, manufactures, and commerce must be grounded in improved education. It was not, however, until the Great Exhibition had gauged and made public our need of improved education, and particularly of secondary instruction, nor until our union with the educational bodies was formed, that the Society could act with effect in the improvement of commerce, arts, and manufactures, by improving the knowledge on which their success must depend.

The Educational Examinations, which we have instituted, are designed to give life and efficient direction to an extensive system of industrial instruction, founded on the revelations of 1851. They are not aimed at children. We leave them to existing agencies; but we hope to strengthen those agencies by enhancing the popular appreciation of education; by requiring a considerable amount of primary knowledge as a condition of admission to our Examinations; and by supplying to primary education its natural and necessary complement in a liberal scheme of secondary instruction. We have a deep interest in the primary school; because it is clear that the secondary, or industrial, instruction with which this Society is concerned should be preceded by elementary instruction of the best possible kind.

Many persons, especially legislators, speak of public education as if nothing or little had been done for it. Doubtless much remains to be done, particularly in reference to that part of the population which is neither technically "pauper" nor independent. Their children are the bane of the National School, keeping down the rate of the school fee below the eleemosynary point, because the managers are unwilling to adopt such a reasonable scale of charges as the independent labourer might readily pay, but these semi-paupers cannot pay. It is much to be wished that this great evil were seriously attacked. By the 18th and 19th Vic., cap. 34, Boards of Guardians are authorised to pay for the schooling of the children of persons in receipt of out-door relief; but this Act has not been effectually operative. What seems to be needed is, that, under careful provisions to guard against abuse, provisions which I fear must be conceived somewhat in a spirit of distrust, the ratepayers of a parish may have some machinery for dealing with the cases of these all but paupers, and charging the rates with their school fees, in whole or in part, on proof of their inability to pay them, and without reference to the receipt of any other legal relief. Provisions of this kind exist in Scotland, in Belgium, in Switzerland, and elsewhere; and, if they could be introduced here, a reasonable rate of school fee might be adopted; and the financial difficulties of elementary schools would be greatly, if not effectually, relieved.

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[*] The Lord of a Manor in respect of the waste or common lands; the authorities of the Duchies of Lancaster and Cornwall in respect of the property of the Duchies; the cestuique trust, or tenant for life, without his trustees; the guardian or curator of an infant; the Committee of a Lunatic; a clergyman in respect of his glebe; indeed, any corporation, ecclesiastical, or lay, sole or aggregate; any officers, justices of the peace, trustees or commissioners for public, ecclesiastical, parochial, charitable, or other purposes or objects; subject to certain reasonable conditions set forth in the Act, may convey any quantity of their land not exceeding one acre for each Institution.

Taking, however, as a whole, the schools rapidly increasing in number which receive annual grants from the Government, I believe that they are the best elementary schools in the world, and not very far from being as good as it is possible for elementary schools to be in this country, where the demands of daily life in the competitions of industry are such that the children cannot be retained at the day school beyond a very early age. We must do what we can to keep up the average of the school-age, because otherwise it will be beaten down lower and lower; but we must make up our minds that we cannot detain our poor children at the day school long enough to do more than lay there a foundation for their future education. We can only prepare them there for their education afterwards elsewhere. The poor man's child is taken from school at the age, or rather before the age, when the rich man's son goes to school. What shall we do then for the poor man's child to save him from the danger of losing the little that he has learned—from feeling that he has been merely mocked with a view of the keyhole of knowledge without a chance of attaining the power to pass within its gates?

The great desideratum seems to be to provide means and motives for the continuance of instruction after the boys and girls have left their elementary schools. This seems to be the keystone of the whole construction of National Education. If we can provide sufficient facilities and inducements for the instruction of adults, we shall place our arts, manufactures, and commerce, on a sound foundation; and we shall secure the interests of religion and morality; because an instructed people will not suffer their children to remain without education; and because, happily, our national education, as far as we have one, is inseparably connected with religion. This, then, is the object of the Examinations instituted by the Society of Arts, to provide means and motives for the continued instruction of adults.

Never forgetting that the Union was formed, not to supersede, but to promote and supplement the action and self-government of the Institutes, the Society invites them to assume a large share of authority and responsibility in the Examinations. The Institutes in different places appoint "Local Boards" to hold a "Previous Examination" of all their candidates in handwriting, spelling, English grammar and composition, elementary arithmetic, and in such of the special subjects as they may respectively desire to be examined in by the Society's Board of Examiners. The names, subjects of examination, and other particulars of the candidates "passed" by the Local Boards, are then communicated by those Boards to our Council; our Board of Examiners prepares, and the Council forwards to the Local Boards, the requisite examination papers. They are simultaneously worked by the candidates in the presence of those Boards. The Boards immediately return the worked papers to the Council. The Council refers them to the Board of Examiners for their adjudication; and the result is communicated, with the least possible delay, by the Council, to the Local Boards, and by the Boards to the Institutions and to the candidates. All the precautions that experience can devise are taken to prevent the possibility of any unfairness of any kind, at any stage of the proceedings. While the candidates have the novel advantage of entering into an honourable competition with their fellows in every part of the kingdom, none is compelled to leave the neighbourhood of his home and the scene of his daily labour.

In the worked papers, submitted to the Examiners for adjudication, there is nothing to indicate the names of the candidates. They are designated by numbers alone. The awards are made entirely by the Examiners, with no interference from the Council or from the officers of the Society. The awards include certificates of three classes:—First, or excellence; second, or proficiency; and third, or competency. So far the Examinations are not competitive, *i.e.*, the value of the certificates is positive, depending on the number of marks obtained by each candidate, according to a fixed standard, and not on a comparison with the work of others. But the awards include also prizes,—and here the principle of competition comes in; the prizes are awarded to those who get the highest number of marks in each subject. We thus combine the advantages of two systems. The certificate, which is the enduring record of the man's attainments, depends absolutely upon the amount of his own attainments; and it would be hard if it were otherwise, where there is so much difference in the opportunities of instruction, where the field is so wide and the candidates belong to so numerous a class: but competition seems necessary to induce men to put forth all their strength; and we present the stimulus of prizes to those who get the highest number of marks among the holders of certificates of the first class in each subject.

We have twenty-three subjects, and twenty-three Examiners. The following is a list of the subjects:—

I. Arithmetic.
II. Book-keeping, by Double Entry.
III. Algebra.
IV. Geometry and Mensuration.
V. Trigonometry.
VI. Conic Sections.
VII. Navigation and Nautical Astronomy.
VIII. Statics, Dynamics, and Hydrostatics, Hydraulics, and Pneumatics.
IX. Practical Mechanics.
X. Magnetism, Electricity, and Heat.
XI. Astronomy.
XII. Chemistry.
XIII. Animal Physiology.
XIV. Botany.
XV. Agriculture.
XVI. Political and Social Economy.
XVII. Geography.
XVIII. English History.
XIX. English Literature.
XX. Latin and Roman History.
XXI. French.
XXII. German.
XXIII. Theory of Music.

Drawing is now left out of our list, not because the Council is of opinion that drawing is unimportant, but because the Government has provided in all parts of the kingdom for annual Examinations in this most important art; and it would be an unjustifiable waste of resources for the Society of Arts to iterate the Examinations held by the Government.

Our list of subjects is certainly not meagre. Nothing could be more mischievous than to institute a scheme of industrial instruction, and to circumscribe it within narrow limits. If it be objected that Latin, for example, is unsuited to a scheme of industrial instruction, I ask whether Latin is not useful to the apprentice of the chemist and apothecary, in the business of a printer, of a bookseller and publisher, of a nurseryman and gardener, in museums, and in every division of science, even in its humbler branches. The people themselves may be trusted to determine for themselves, as adults, what they will learn. They will soon know what they want, what helps them forward in their callings, and what interests and recreates their minds in the intervals of labour. The papers set by our Examiners have, however, as far as possible, a practical character; and, though the

Society of Arts prescribes no curriculum of studies, the Committees of the Unions and Institutes and the Local Boards advise, and by advice guide, their students.

The names of our twenty-three Examiners will bear comparison with those of any other Board of Examiners in the kingdom.

In addition to the certificates and prizes, an encouragement of another kind has been opened to the candidates. The late Mr. John Wood, chairman of the Board of Inland Revenue, Lord Granville when Lord President of the Council, and Lord Palmerston and Lord Derby as First Lords of the Treasury, allowed the Council of the Society of Arts to nominate to junior clerkships, or to competitions for junior clerkships, in the public service, some of the candidates that succeeded best in the examinations. Four nominations to compete for appointments were placed last year by Lord Derby at the disposal of the Council. Four prizemen were nominated; one from the Crosby Hall Evening Classes, one from the Young Men's Christian Institute at Leeds, one from the Literary Institution at Lymington, and the fourth from the Mechanics' Institute at Leeds. All four succeeded. Two of them competed for clerkships in the Customs and were placed 1st and 3rd. The other two competed for supernumerary surveyorships of taxes, and they were placed 1st and 2nd. I should be sorry to see the day when the youth of this country were generally looking to the Government for employment; but such a catastrophe is little likely to happen while the service of the Government exhibits only its present inducements; and, if all its minor appointments were thrown open freely, as I think they should be, to public competition, under proper conditions, an undue determination of juvenile ambition towards the public service might easily be prevented by opening in like manner to competition the analogous but better paid appointments of the public companies, of the great commercial establishments, and of private service.

If this principle of competition, which is now the exception, were to become the rule, in making public and private appointments, both the public and private services would be greatly gainers; and public education would become an accomplished fact, instead of tossing in a sea of interminable discussion, in the sickness of deferred hopes. Our object is not so much that individuals may be raised above their class, as that the level of the whole class may be raised; not that ignorant men should become smatterers in abstruse subjects, but that a man should lay a solid foundation in elementary knowledge, and then acquire its appropriate secondary additions: and we believe that, in holding out to him encouragements and rewards for success, we promote an increase, not only of intellectual attainments, but also of energy, perseverance, self-control, and moral habits.

In 1854 the Society of Arts and the Institutes first agreed that their students should be annually examined by a Board appointed by the Society. In 1855, only one candidate, a chimney sweeper, presented himself; and no candidate was examined. The Society had been passive and the Institutes were unprepared. In 1856, 52 candidates underwent Examination. In 1857, in this house 80, and at Huddesfield 140, total 220 candidates underwent Examination. In 1858, when the Examinations were first divided into Previous Examinations by the Local Boards, and Final Examinations by the Society's Board, and when a minimum of the age of candidates, viz., 16, was for the first time fixed, 1107 candidates, at 32 different places, underwent the Previous Examinations, and 288 underwent the Final Examination. In the whole, 394 candidates have received 863 certificates.

Some curious details of the results of the Examinations in 1858 were given by Mr. John Pope Hennessy, in a paper read before the British Association at Leeds. Each candidate who has "passed" the Examination of his Local Board, and desires to undergo the Final Examination of the Society's Board, furnishes the Society with a return containing the following particulars:—His name, age, residence, occupation present or proposed, the Institution with which he is connected, whether he is a student in a class there, the number of years that he was at school, the number of years that have passed since he left school, his father's occupation. I need not point out how important these returns will become in a few years. Mr. Hennessy shows from the Returns of 1858 that, of 310 candidates from whom they were received,

1	candidate had been	14	years at school.
7	,, ,,	12	,, ,,
1	,, ,,	11	,, ,,
18	,, ,,	10	,, ,,
21	,, ,,	9	,, ,,
40	,, ,,	8	,, ,,
46	,, ,,	7	,, ,,
47	,, ,,	6	,, ,,
49	,, ,,	5	,, ,,
32	,, ,,	4	,, ,,
22	,, ,,	3	,, ,,
11	,, ,,	2	,, ,,
2	,, ,,	1	,, ,,
13	had been less than	1	,, ,,

Mr. Hennessy shows that, comparing the 129 candidates who had been at school for less than 6 years with the 181 candidates who had been at school 6 years and upwards, the former did better than the latter. He says:—"Although this result is a fact, and, as such, is probably worth volumes of speculations on the theoretical aspect of the question, yet I do not think it can justify any positive conclusion of much value. Should it be confirmed by the experience of future years, and by a still more widely extended inquiry, it may become a question whether Institutional Education —to which, as a matter of course, it is almost altogether owing—ought not to be regarded as a system of popular instruction coming as fairly within the scope of Parliamentary support as the Elementary Education in the Schools under Inspection." I entirely agree with him that we must wait for more information before we found any theory on these returns.

This year, and henceforward, the Examinations will be held, simultaneously, at all places, throughout the Union, in England, Scotland, Ireland, and Wales, wherever there are candidates and a Local Board.

The Final Examinations this year are fixed for Tuesday, Wednesday, Thursday, and Friday, the 17th, 18th, 19th, and 20th of May, from 6 to 9 in the evening.

Any person, not less than 16 years of age, may be examined, on the recommendation of a Local Board, provided that he (or she) has been for three months a member of, or a student of a class in, an Institute united to the Society, and is not a graduate or undergraduate of any of the Universities, a student of a learned profession, a certificated schoolmaster or schoolmistress, nor a pupil-teacher salaried by the Government.

The "Local Boards" were contemplated in 1854, but were not brought into existence until last year, when they played a most important part. It is difficult to overrate the importance of the full development of this new kind of Institution. It springs at the suggestion of this Society from the Institutes themselves, comprehends and represents their interests, and possesses their full confidence. Dealing with the results of the instruction of adults, instead of attempting to define the processes of the education of children, the Local Board knows nothing of the odium theologicum; and, not only without any sacrifice of principle, but, without the least occasion for scrupulous hesitation, comprises the representatives of all classes in society, and of all parties in Church and State.

Merely to sift the Candidates and to admit them to the Final Examination, the work of the Local Board may be done by two or three intelligent persons who possess the confidence of their Institutes; but, in most instances, the Board is a powerful and somewhat numerous body, whose influence upon the education of its neighbourhood cannot fail to be very great indeed.

At the Annual Conference of the representatives of the Institutions in June last, it was agreed that the Local Boards would do well to concern themselves, where their assistance would be welcome, in preparing candidates for Examination, by advising them respecting their studies, and by inspecting the classes from time to time. On the same occasion, also, it was resolved that it would greatly promote the interests of public education, and the success of the Society's Examinations, if the Local Boards should act as administrators of what are now well known to educationalists as "prize schemes" for children between 13 and 16 years of age, so as to induce them to continue their instruction between the time at which they usually leave their elementary schools, and the time at which they become admissable to the Society's Examinations. Many a parent would be induced by the prospect of his child's obtaining a valuable prize, to postpone his withdrawal from the day-school, or to ensure the continuance of his instruction at an evening school or class. The prizes would not be mere prizes, but honours and testimonials. It would be a great advantage to bring into a friendly competition, under the impartial auspices of the Local Boards, the pupils of National, British, and other schools, which have now no opportunities of direct competition, nor of friendly emulation provocative of improvement.

Besides our own general Union of Institutes, there are in Union with us many Provincial Unions of the greatest value, such as the Yorkshire Union of Institutes, the Lancashire and Cheshire Institutional Association, the Union of the Four Northern Counties, the Hants and Wilts Association, the Bucks and Berks Association, the East Lancashire Union, the Sussex Board in aid of the Local Examinations by the Society of Arts and the Universities, and others. The East Lancashire Union, whose President is Sir James Kay Shuttleworth, has been very carefully organised, and has adopted a scheme of well graduated, continuous instruction. The Committee of Council on Education has granted to the managers of this Union an augmentation of salary for a certificated schoolmaster, whose duty it is to act as an organising master to those Institutes, visiting them and teaching at them in turns; and also an augmentation of the salaries of all the uncertificated teachers who teach regularly at the Institutes under the periodical superintendence of the certificated master. This small Union is doing a real work of education. Its area is so limited, that every part of it is under the eyes and within the reach of its Committee of Management, which takes care that the scheme of instruction is effectually carried out. This is very important indeed.

In almost all of the provincial unions examinations are held and certificates and prizes are given independently of ourselves. In May last, at Manchester, 1,000 candidates were examined by the Lancashire and Cheshire Association. The Sussex Board has framed an admirable scheme for the encouragement of candidates. Not only prizes of considerable value are offered, but it is proposed in certain very meritorious cases to grant exhibitions to assist suitable candidates to obtain an university education.

Several of the Provincial Unions were in existence before our Union was thought of; and I know no Provincial Union which has done more for the Institutes than the great Yorkshire Union, which comprises 130 of these bodies, and is, I believe, the Father of Unions.

Besides the prizes which the Society of Arts grants to the successful candidates, the Society grants also prizes to the Institutions whose candidates take the highest prizes, and to the Local Boards whose successful candidates bear the best proportion to the unsuccessful. In 1858, the Institutions that carried off prizes were the Watt Institute at Portsea; the Crosby Hall Evening Classes; the Banbury Mechanics' Institution; the Young Men's Christian Institute at Leeds; the People's College at Sheffield; the Athenæum at Bristol; the Mechanics' Institution at Leeds; and the Literary Institution at Lymington. No Institute can now receive a prize unless the Council is satisfied that the candidate in respect of whom the prize is claimed has received, at that Institute, for three months, systematic instruction in the subject for which he obtained his prize. The Local Boards at Crosby Hall, and at the London Mechanics' Institution, received last year a prize of £10, and a prize of £4.

You have gathered, I hope, from what I have said, that the Society of Arts is engaged in a great educational enterprise. In the last few years, at the suggestion of this Society, there has been growing up somewhat silently a combination of a very peculiar character. It is co-extensive with the United Kingdom, most powerful in the seats of dense population, but operative even in thinly-peopled villages, irrespective of political and theological divisions, springing from the institutions of the working-class, but supported by good men of all classes, having its centre in our own metropolitan Society of Arts, from which an impetus is conveyed to the Provincial Unions, Local Boards, Athenæums, Institutes, People's Colleges, Evening Classes, and even to isolated students; and even now, in the infancy of this Union, large numbers of the working classes have shown themselves ready and anxious to profit by it. Here, then, may we not hope that we have done something to supply our great desideratum in public education? Are there not here provided motives and means for the continued instruction of adults? What we have accomplished, has been accomplished not by the action of the legislature, nor by the Government, but by the union of this independent Society with those independent Institutions of local growth and of popular origin. Does anyone ask how can he contribute to the success of this Union? I reply plainly, "Become a member of the Society of Arts; subscribe to its special fund for prizes; support the Institute or Athenæum of your own neighbourhood; regard our certificates as effectual testimonials when you are called upon to dispense patronage and employment. Explain to those, for whose advantage the Examinations are instituted, how to profit by them." Any member of an Institute in Union with us, whether a student of a class there or not, and any student of a class there, whether a member of the Institute or not, may take advantage of the Examinations.

Much yet remains to be done for the Institutes, and still more by the Institutes for themselves, before they can realize the idea of utility which was in contemplation when the union was proposed. They are not the failures that some persons have supposed them; their legal status and their popular character are much improved; their financial condition is improved; they are very useful as places of amusement—amusement unconnected with public-houses —which is really a primary want in this country, where it seems to have been thought till lately that to make a man religious and wise it was requisite to keep him dull; they are very useful as reading-rooms and news-rooms; their libraries are of great value; they knit together the various classes of society; and they have now entered vigorously, and with capital prospects, upon the work of systematic instruction. Their students are to be counted by thousands. Their great difficulty in the work of instruction is the difficulty of obtaining well qualified teachers. The supply of these is unequal to the demand, —nor likely soon to overtake it. The most competent teachers are those who, having been trained at the Normal Schools, under the inspection of the Committee of Council on Education, are entitled to annual augmentations of salary from the public funds when engaged in inspected schools. These teachers, however, are not available for our Institutes. Sir James Shuttleworth has recently published a statement that the aid which has been given by the Committee of Council to the East Lancashire Union of Institutes, has not been, and is not likely to be, given to other Unions or Institutes; and he has publicly declared that, by the pecuniary advantages recently awarded to evening classes held in day schools which are under inspection, the classes of the Institutes, being debarred from those advantages, will everywhere be placed at a great disadvantage in comparison with those schools; that the latter will receive an extraordinary stimulus, and be rapidly multiplied as successful, and perhaps fatal, rivals to the classes for systematic instruction in the Institutes which are not inspected by her Majesty's Inspectors of Schools.

The friends of the Institutes are not agreed as to the expediency or inexpediency of receiving pecuniary assistance from the Government. For my part I have never been able to satisfy myself that it was expedient for them to receive such assistance in aid of their general purposes. If the Government grants money to the Institutes, it must take security for the best possible application of that money, that is to say, it must inspect them; and inspection, if not control, is influence; and such influence has a strong family likeness to control. Would it be expedient that these popular Institutions, with their lectures, discussions, libraries, reading-rooms, newspapers, and amusements, should be subjected to governmental influence, even in homœopathic doses? I think not. But I see no reason why funds voted by Parliament "for the promotion of public education" should not be applied, in reasonable measure, to the support of the classes for instruction in the Institutes, by allowing the certificated teachers to receive for teaching therein the parliamentary augmentations of their salaries, and by payment of capitation allowances in respect of students who satisfactorily pass the annual "Previous Examinations" of the "Local Boards." The effect of this concession would be that the inspection, which is invaluable in the case of an elementary school for the education of children, would be substituted in the case of adults by a testing of the results of instruction, the test being applied in the presence of her Majesty's Inspector, if his presence be thought necessary to prevent the possibility of a misappropriation of public money, but applied by an authority which is local, public, and independent of the Government.

Sir James Kay Shuttleworth has omitted (I think) to state the grounds on which, with the exception of his own union, the Government restricts its grants to those evening classes which are held in buildings in which day schools under inspection are also held. If these grounds are condemned, the condemnation should attach rather to Parliament than to the Committee of Council on Education. Parliament has shown a marked disinclination to alter the basis of religious compromise on which it has entrusted to the Committee of Council the duty of distributing the Parliamentary grants. It has always been a fundamental rule that, in the schools inspected, the Bible shall be daily read; and, when evening schools were first recognised by the Committee of Council, it was laid down that, to avoid the re-opening of religious controversies, that rule might be held to be sufficiently observed if the evening school were treated as one institution with the day school maintained under inspection in the same building, and under the same management. The question of evening schools and classes has, however, become immensely important; and surely it is almost time for Parliament to distinguish between the education of children and the instruction of adults; and to admit that an adult may very properly receive instruction in mathematics, chemistry, or botany, without being compelled to receive it in an uncomely and uncomfortable apartment where, not he himself, but some small children, unbeknown to him, have heard a portion of Holy Scripture read in the earlier part of the same day. I agree with Sir James Shuttleworth, that it would be a very grave misfortune indeed if the classes at our Institutes were to be damaged by a general setting up of rival classes for adults in connection with the inspected elementary schools for children. From such a cause the elementary schools would be the first to suffer. If their school-rooms are to be occupied from early morn to dewy night, they cannot be properly cleaned and ventilated; and they who have the charge of the buildings, almost invariably the schoolmaster and schoolmistress, must suffer from the additional responsibility and restraint, even if they have not in addition any actual labour, thus cast on them. Moreover, the fittings, the benches, and desks, which are suited to the children of the day-school, are totally unfitted for the long legs and broad dimensions of adults. Two sets of fittings cannot occupy the same room. There will be a compromise of sizes, and both parties will be inconvenienced. But it is a graver objection that the formal connexion with a particular religious congregation, which is a common feature of the management of the day-school, and produces excellent results in the religious education of the children, is uncalled for, and not calculated to be useful, in respect to the instruction of adults. With every day school let us connect an evening school for the elder children; but we may impair the independence and robustness of character which we wish to see in our countrymen if we treat them, adults, as children, and send them for their industrial instruction to schools, where neither they nor their fellows partake of the power of government, instead of to their own Institutes and Colleges, which they themselves have established, and which they and their fellows take part in governing.

It may be objected that in the day schools, where the Bible is read, there are religious influences, a sort of religious atmosphere, which would be wanting in the Institutes; and that it would be better for the interests of religion to continue the existing restriction. I entirely dissent from this view. There are no grounds whatever for imputing to those who are connected with Institutes an indifference to the highest and best interests of man; and much harm is done to the cause of religion among working men, when they find its name brought into requisition, in order to impose on themselves restrictions which are not imposed upon any other class in the community. The more a man is reputed to be actuated by genuine religion, whether he be a clergyman or a layman, the more influence he will have among the other managers and members of an institute, if only he have a fair share of common sense and general knowledge, and be modestly desirous to co-operate with them as a brother among brethren, instead of to rule them as a superior.

A word now about other matters. In every town, in every large village, I conceive that there ought to be, and that there might be, an Institute not only doing what has been here mentioned, but promoting progress and improvements of all kinds. Everywhere there is an urgent want of some body whose acknowledged function it is systematically to investigate and to diffuse information respecting objects of practical utility. If the Institutes would generally undertake this duty, they would raise their own position by doing a great deal of good, and would gather to themselves many helpers who now stand aloof. I conceive that each Institute should be, in operation, an Institution for the promotion of social science. With great advantage they might deal, by inquiry, discussion, and publication, with many of the subjects which this Society deals with and promotes. Many of the Institutes have discussed and expressed to Parliament their conclusions respecting our old enemy, the duty on paper. Some of them have discussed the question of a small parcels post; others the laws of patents; others allotment gardens for the poor; others the early closing of shops; others the subjects of warming and ventilating, the economy of fuel; many of them have discussed and diffused useful information on sanitary matters; a few of them have classes for the study of political economy. Here is a subject of vital importance to every human being, and there is scarcely a score of towns in the kingdom where political economy has a teacher. Who can calculate the mischiefs that have been done by the best intentioned persons ignorant of its guiding truths? There is a limit to Parliamentary power. Parliamentary legislation cannot be enlightened unless the people are themselves enlightened. Neither the Government nor the Parliament can now do much—I might almost say anything—for the benefit of the people without the co-operation of the people. Reforms, sanitary, educational, commercial, fiscal, are obstructed by the inertia of public opinion. They would be rapidly developed if the public mind were prepared for them by the systematic action of Institutes ventilating them in all parts of the Kingdom. There is no necessary connexion between social reforms and political controversies. The latter are wisely excluded from the Institutes.

In many towns the Institutes have held with success occasional Exhibitions of Art and Industry, of natural and manufactured objects. This mode of teaching by the eye is invaluable. Some people are apprehensive that by holding too many exhibitions we shall give an undue stimulus to the production of novelties. The Society of Arts, however, knows that there can be no improvement except by novelties, and that its own function for one hundred and five years has been, and still is, to promote improvement by encouraging the novelties, which it calls inventions, that are good, and by discouraging those alone which are bad.

People say to me, "Why do you take such an interest in those Institutes, and make such a fuss about them? We do not see that people are made more religious by the study of science and art." I hope that the paper which I have now read contains some reply to that inquiry. Science and Art appear to me to be necessary to be included in our national education, and by education people are helped to be religious. When the archdeacons of the diocese of Chichester became members of the Sussex Board, which is created for the purpose of co-operating with us, they did not act ininconsistently with their spiritual character. Mr. Best ministering in his parish church at Abbott's Ann, and Mr. Best establishing the Hants and Wilts Association, and labouring zealously in its work, is one and the same minister of religion worthy of double honour. Canon Girdlestone, the energetic educator of children in the principles of the Church of England, is the same Canon Girdlestone that, as Chairman of the Local Board at Bristol, brings invaluable qualities to its aid. The Prelate who preaches the Word to multitudes in the neighbouring Abbey and in his Cathedral, and in the humbler structures which serve as churches in Bethnal-green, is the same Bishop of London who is President of the evening classes at Crosby Hall—but I forbear. We cannot all be preachers of the Gospel, but we may all obey its precepts, and endeavour to do to others what we should wish them, if our places were reversed, to do to us. I have endeavoured to show what the Society of Arts' Union of Institutes is, what its several constituent parts are doing, and what they might be led to do. It can hardly be doubted that the Institutions deserve the respect and support of the public, *i.e.*, of the individuals who form the public. If any one then who has done me the favour to listen to me, or who may read this paper in the *Journal*, should be of opinion that the usefulness of the Institutions, already great, might be very greatly increased if they were fully developed in the manner suggested, I hope that the Society of Arts may rely on his active co-operation in the promotion of its somewhat difficult enterprise.

DISCUSSION.

Sir Thomas Phillips said, although it was not his intention, when he entered the room that evening, to address the meeting, it had been intimated to him that it was desirable that, in the first instance, some member of the council should offer a few observations upon the excellent paper they had heard read; and when he saw around him so unusually large an audience, he could not doubt that the subject was one of peculiar interest. He was sure that all felt greatly indebted to his friend, Mr. Chester, not only for the labour he had bestowed in presenting to the meeting a history of the educational branch of the Society's operations, but for laying before them, in the clear manner he had done, the ends which the Society contemplated. And they would feel not the less indebted to him when they recollected, as probably most present would do, that he was, in fact, the author and originator of the movement itself. Elementary education had, for many years past, been largely fostered in this country, and, not only had schools been very widely diffused throughout the country, and the facilities increased, but the character of the education afforded had been greatly improved; nevertheless, in the contest between instruction and labour it must be known to all who had taken part in the education of the people, that the school period was far too short. At 10, 11, or 12 years of age the child escaped from the discipline of the school, and in many instances lost altogether the advantages there acquired. The problem that was found so difficult on the part of all the friends of education was this, viz:—in what way, between school age and adult age, was the instruction given at school to be continued, and how were the influences that were produced in the school-room to be deepened and strengthened? Mechanics' Institutes, evening schools, evening classes, and other means had been devised by the friends of education to supplement the early school life of the working man's child to some extent. These perhaps had succeeded, but still they were far from satisfactory. The object of this movement—and he believed it had to a considerable extent been accomplished—was by providing for the best (because it was only the best of the children of the poor who would ultimately rise by means of any instruction or advantages offered)—by affording to the best conducted, the most intelligent, and those most desirous of carrying forward the instruction they had received, the means, largely by self-culture, and partly by the advantages given in aid of self-culture, to preserve and increase that knowledge which they had already acquired, so as not only to enable them to do their duty in the state of life in which they were placed, but to elevate themselves to a somewhat superior condition of society by the employment of those abilities and the improvement of those advantages that they might have had. Let it be observed that in this work nothing had yet been done by the government of this country, but it was altogether through the spontaneous agency of the people themselves. And let them remember, too, that this was the most difficult portion of the work, that the character of the persons by whom it was to be carried on ought to be of a superior kind to that of the mere schoolmaster. These young persons who were resolved upon the work of self-improvement were, in fact, the salt of society. It was not given to the many to succeed. There were not many George Stephensons in the world, but there would always be found a large number of average intellects, who by the devotion of their leisure time to self-improvement, and by availing themselves of the agencies by which they were surrounded, might become most valuable members of society. We were now placed in a period in the history of industry in which intelligence year by year became more important, in which mere brute force lost year by year its value, and in which this country was exposed to the competition of other countries where the artizan had large advantages supplied by the state, and was enabled to acquire that knowledge which it was our duty to assist the working man of this country in obtaining for himself. It was true that the working classes had, in their school years, the means of instruction, and the endowments of former times afforded to the rich the advantages of colleges and universities for the completion of their education and their preparation for the business of life; but the boy who left the elementary schools of the poor and went to labour, had no other advantages than those which Mechanics' and similar Institutions afforded them, and which this Society was now earnestly endeavouring to foster by means of that system of Examinations which had just been so ably described to them.

Mr. **Sidney** acknowledged the services rendered by the Examination system of the Society of Arts, in stimulating the zeal and gauging the value of Mechanics' and other literary institutions, but he believed he expressed the opinions of a very large class when he hoped that no further attempt would be made to reward successful students with official appointments, a course which could not but tend to corrupt and emasculate the character of our studious youth, by leading them to look to Government employment instead of to private enterprise and personal and continued exertion for success in future life. All parties in the State were agreed on the propriety and necessity of extending the means of education to the humblest classes, by schools for infants and for adults by day and by night, by Examinations, and above all, by reading rooms and by libraries, by good and cheap books; but he thought that Mr. Chester had somewhat exaggerated the value to be derived by the working classes from literary and scientific education, and had somewhat unfairly depreciated the position held by the British workman at the Great Exhibition of 1851, as compared with the foreign workman. After all, the principal part of the education of the working man must be directed to learning the business by which he was to get his living, and such literary and scientific education as he could find leisure to obtain would give him resources in reading, in writing, and conversing, in lieu of merely sensual enjoyments. To own the truth, there were very few in any class of society who were capable of using the advantage of a scientific training however freely offered. As to the results of the Great Exhibition, the inferiority of British work lay only where the arts of colour and design were involved; wherever the work required high mechanical skill and solid workmanship, the superiority of the British workman was undoubted. Our mechanical and railway engineers, our coal miners, and our agriculturists, were the first in the world, and went or sent their work all over the world to execute undertakings too difficult for the best men of those countries where Polytechnic Schools, Agricultural Colleges, and Mining Colleges attracted all the first talent of the middle and working classes. France drew the cream of the middle classes to her engineering staff and army; Prussia absorbed in government employment the pink and flower of even the humblest classes. In England we had not been in the habit of stimulating the sons of ploughmen by offering them the dignity of beadles or the emoluments of excisemen; and he hoped we never should attempt to waste the vigour of youthful talent in the routine of Government employment, but continue to encourage young students of the working classes to look to private and personal enterprise for success in life. George Stephenson's name was frequently quoted as an example of the need of education and competition, and, perhaps, of Government rewards. He (Mr. Sidney) believed that the most important part of Stephenson's education was obtained in working for his living in the mine and at the steam engine; and that less great results would have been obtained from a school and collegiate training. Certain he was that if Stephenson had had to pass the ordeal of an English Official Board of Engineers and Miners he would never have been permitted to emerge from obscurity. In France the Government officials were the great obstructers of early railway enterprise. He thought that with more schools for children and adults, more good, useful, practical books, more reading rooms, and more free libraries, with the stimulating aid of the Society of Arts acting upon them, the work of education would be carried on without the stimulus of prize excisemen or even prize Somerset-house clerks.

Vice-Chancellor Sir **William Page Wood** said he had come there to receive information rather than to speak himself; and he had been much interested by the very able paper they had heard from Mr. Chester. He felt a deep interest in this subject, although he had not—(perhaps he should be ashamed to say so)—taken any active part in the proceedings of the Society in this matter. But for the last eighteen years he had been connected with a Mechanics' Institute, in which he had taken great interest, but which proved, as many others had done, a complete failure. He thought, however, the steps that were now being taken by this Society were likely to prevent the recurrence of such a lamentable state of things. That such institutions had failed was a matter too notorious for any real friend of education, who did not seek to cloak the truth, to hesitate to declare. On a late occasion, there was a conspicuous failure of a certain institution in this metropolis. He was himself connected with one of a more humble character, but which, after a long struggle, was found to be incapable of maintaining itself; and his opinion had always been, that, unless those institutions could be made self-supporting, they were really nothing worth. On that account the institution with which he was more particularly associated, not receiving extraneous aid, had become converted into an institution which was at present, he was sorry to say, the only one of its kind in London—viz., a free library. That there should be only this one free library in London, was certainly surprising. He thought there must be some great want of energy and zeal on the part of those who undertook to form libraries under Mr. Ewart's Act. Still, the fact remained that the free library of St. Margaret's and St. John's, Westminster, was the only institution of its kind in London. In the third year of its establishment it was attended by no fewer than 74,000 persons, and, whereas, during the first year, the books that were read consisted of only one-fourth solid literature and three-fourths light literature, in the last year it was found that the reading consisted of one-third of solid literature, and two-thirds of that of a lighter character. He believed it was not foreign to the present meeting to mention that, for it was a part of the business of the Society of Arts to grant to free libraries in Union with it the privilege of obtaining books at greatly reduced prices—a privilege of which his own institution had largely availed itself. He agreed very much with what had been said by Mr. Chester—that however deeply they might be impressed with the absolute necessity of combining religious education with the instruction of the child—yet he believed they might with regard to the adult enter upon a different course, not because they undervalued religious education, but because they believed that the adult was already sufficiently instructed in it. With regard to the statistics presented by Mr. Chester in connection with the Examinations, he was a little alarmed at the statement, that out of 310 candidates for Examination it was reported that those who had been the smaller number of years at school were upon the whole found to be most successful. But when he came to look at that report it was not so alarming as he had anticipated, for it appeared that out of the 310 persons there were only 26 who had been at school for less than three years. He apprehended that in those three years, if well selected, a large portion of instruction might have been instilled into their minds. Another result, which he had gathered from these statistics, was, that it was clear that these Examinations had not reached the children of the elementary schools, but that it was with the higher classes of schools they were principally dealing. They had not got to that class which formed the bulk of the population under instruction in the elementary schools, the average of whose school days, he regretted to say, was far below three years throughout the country. At the same time he felt that a vast amount of good was likely to result from these Examinations. It was an incitement to the members of Mechanics' Institutes in particular, not to allow their institutions to degenerate into mere places of amusement and recreation, as he feared was at one time too much the case, but to render them places where they could reap the fruits of the education given in their childhood. There appeared to him to be no reason why candidates for examination from the Mechanics' and other Institutions should be stigmatised as place-hunters, because the Government gave an opportunity to successful candidates to compete for appointments under Government. From all the experience he had gained, he was of opinion that, in general, government remuneration for labour was the lowest in the country, and therefore he had no fear of persons being unduly drawn from the ordinary departments of labour by the allurement of government situations. Reverting again to the subject of Mechanics' Institutes, he would say, if ever they hoped to make them self-supporting, without which he considered they were worth nothing, the best way to do it was to give the people a clear insight into the practical advantages that might result from them to their children, for in England it was found, even amongst the lowest and most depraved of society, that there was a strong desire existing to promote the interests and the welfare of their children. Moreover, the affording an opportunity of having the knowledge acquired in these institutions tested in such a manner as to be useful in after life to those passing these Examinations, was, in fact, conferring a most important benefit upon Mechanics' Institutes. One word more upon the subject of free libraries. When inquiring into the results of the working of the free library to which he had alluded in the early portion of his remarks, he ascertained that some dissatisfaction was felt that, being a free library, persons came there from other parishes. Upon inquiry, it was, however, found that 75 per cent. of the persons attending were of their own parishes; but there was one circumstance which caused him much pleasure, viz., that many persons came there from a long distance, because it was the only free library in London, and there was one instance of a working carpenter coming two or three times a-week from Gravel-lane in the City to consult a practical work on architecture. This was not a solitary instance, and was most encouraging to those who were really interested in the great cause of education. He believed the measures taken by this Society were most valuable. They would not, he was sure, wish to have it said that they were perfect, and that all their arrangements were the very best that could be adopted, but they had certainly taken a step in the right direction, and he heartily wished them prosperity in the laudable efforts they were making.

Sir J. Kay Shuttleworth, Bart., said, allusion had been made in the paper not merely to the East Lancashire Union of Institutions, but also to some opinions which he had expressed in reference to the relation which the Mechanics' Institutes of the country had to the Committee of Council on Education. He was anxious that what he had publicly stated should be well-understood by the Society, as he thought the relation which the proceedings of the Society, with respect to Mechanics' Institutes, had to the general education of the country, was deeply important. Mechanics' Institutes in the present day consisted of libraries, news-rooms, and evening schools, but the latter, fostered by the Society of Arts, and the stimulus of its system of examinations, had of late years steadily grown in importance. In Lancashire, Yorkshire, and Cheshire, there were 2,000 young men attending the evening schools of Mechanics' Institutes, which was in the proportion of 1 to 1½ per cent. of the population. If evening schools were to do any part of the work of carrying on the imperfect education of the day schools of children, the evening schools would require agencies which did not at present exist. Upon this point the recent minute of the Education Board would after a few years become of very great importance to the country. In order that that might be fully understood, he would ask the permission of the meeting to explain, as briefly as possible, the relation of that minute to the day schools of the country. At present, the day-schools were conducted by certificated masters, assistant masters, and pupil-teachers. The Government permitted elementary schools to have the benefit of certificated assistant masters in the day-schools, and thus to relieve the principal master to such an extent that he was able to teach also in the evening-school. This rendered possible the establishment of efficient evening-schools in connexion with the day-schools. What was about to happen in the history of the education of the country was this. There were at present about 16,000 pupil-teachers. The Training Colleges of the country were capable of sending out 1,000 trained masters per annum. Therefore, there was a good prospect that the Training Colleges might, in a few years, overtake the wants of the country as respected the supply of head-masters of the day-schools; and, where this was the case, young men who had passed through the Training Colleges might accept the post of assistant-masters, at inferior salaries. When that period arrived, the facilities for the adoption of this system would be great throughout the country; and in the manufacturing districts especially, certificated assistant-masters would be appointed; evening-schools would be established almost universally, in connexion with the day-schools, and taught by two masters, with voluntary aid from local agencies. Every one would rejoice if an agency of that kind was provided; and in the Government minute that system was admirably provided for, and he believed that agencies at present at work in the country, in addition to the growth of the normal-school system, would enable the Government to carry out the views they had in contemplation as to certificated masters of day-schools leading to the establishment of efficient evening schools. But it must not be forgotten that one immediate result of this would be, probably, in populous districts, to thin the ranks of the classes for instruction in connexion with the Mechanics' Institutes. Unless some other agency existed, it would be impossible to attract 20,000 young men to the evening schools in the three counties he had named. The evening schools were, to a great extent, taught by the masters of the day schools, and the effect would be to withdraw the scholars from the Mechanics' Institutes. There would be a little revolution in this respect. It would be a misfortune if Mechanics' Institutions should be injured. They were places where all parties generally united, without distinction of religious doctrine or political sect, except in some few instances. By various means, some of which were not developed, they beneficially affected the course of public opinion in their districts, and they substituted a useful and salutary form of discussion for others which might be acrimonious, anti-social, and irreligious. None of those institutions, either in their libraries, their lectures, or in any other respect, were anti-social or irreligious. They had for years past been the spontaneous results of local exertion; they had raised themselves to their present position, and would go on developing themselves if they were allowed to remain without external interference. He did not say that that was a reason why the minute of Government should be withdrawn, but he rather thought it should be rendered available in some form for the benefit of those institutions. He thought such a minute ought not to be allowed to operate to the injury of institutions at which 20,000 young men would receive evening education. Government, looking at this question, might extend the experiment of the East Lancashire Union, by granting modified aid to Mechanics' Institutes having evening schools attached to them. They would be placed more in a position of equality with the evening schools inspected by the Government, it the capitation grant were extended to them. He begged, in conclusion, to say that he had not treated this subject in a controversial spirit, but rather to enable the Society of Arts to apprehend the great importance of this minute of the Government, and to define what the operation of it would be, and also to define the relation in which it stood to Mechanics' Institutes in general throughout the country.

Lord JOHN RUSSELL, M.P., said, he had attended for the purpose of listening and receiving instruction, and not for the purpose of obtruding any observations of his own upon the society, but he could not refrain from expressing the pleasure he had derived from hearing the paper which Mr. Chester had read. It showed, in an admirable form, very concisely and at the same time very fully, the benefits conferred by the Society of Arts upon the general education of the country. The Society was now engaged in fostering education—not by some great and vast plans proposed by the government, and which the public had adopted; but the people of this country were doing with regard to education, what might be done with regard to many other subjects, namely, they were working out for themselves a very important and a very difficult problem; and in the course of working out such a problem, many failures must happen, many mistakes must be made, but in the end he thought they would find—being worked out by the people themselves, and aiming at an end consistent with the liberty of every person in the country, it would produce a far better system than any which the wisest legislature could have contrived. And let him say, as an illustration of what the learned Vice-Chancellor had mentioned with regard to the failure of some Mechanics' Institutions, that Dr. Birkbeck was an able man as well as a benevolent man; but, in the first place, he was disposed to think that the effort he made was premature; that the country was not prepared, at the time he proposed it, to make an effort which perhaps twenty years later would have been perfectly successful. In the next place, he thought, in the absence of all experience, some errors were made which experience alone would enable him and those who established these Mechanics' Institutes to avoid. But he mentioned this only as an instance, of which there must be many, that they should not be discouraged—either this Society or the community in general, should not be discouraged by partial failure; but, on the contrary, they should believe that in different ways they were seeking an end which would be obtained through success and through failure, through hope and through disappointment, and that it would succeed in the end better from the free and voluntary character of the effort that was made. With regard to what had been said by Sir James K. Shuttleworth upon the subject of governmental aid — in the first place, he thought they must be very cautious with regard to any further efforts that were to be made, either by the Committee of Council on Education or any other body belonging to the Government. He believed the efforts made in assisting education, and endeavouring above all to improve education—in which a high degree of honour was due to Sir James Shuttleworth, who had suggested more improvements in preliminary education than any other person had done—he believed the proposals made by the Government in the system of aiding voluntary effort, and at the same time providing and declaring that religious instruction must form part of the education of the people in general—he believed that system was a right system to adopt; but when they attempted to carry it further, there were many difficulties to be overcome. First with regard to local distribution, they found that in the large towns it was easy to open schools, and to have many schools of different kinds of religious communities; but with regard to the south and west of England they found a great many parishes in which they could not collect fifteen children of both sexes in a school. It was not likely that good schools could be formed in such parishes as these; and one would naturally recommend that several parishes should be joined —but they found that those who had charge of the education in these parishes, although much in favour of education—were nevertheless opposed to such a combination for that purpose. It was not only that the clergyman of the established church differed from the dissenting minister, but the clergyman of one parish differed from the clergyman of another parish. Therefore whilst it was easy to say—educate all the people—yet these apparently small difficulties, which the theoretical speculator would brush away as a mere cobweb, were effectual stops to education in the small parishes in the south and west of England. But then he felt very much with the gentleman who had recently spoken (Mr. Sidney), that this country had better continue to maintain that jealousy of Government interference, which was one of its special characteristics. There were various evils connected with Government interference. In the first place, the people themselves became jealous of that interference; in the next place, it should be recollected that there were two questions inseparably connected, namely, the giving of large sums of money as Government grants, and the laying taxes upon the people to support those grants; and accordingly they found, instead of combining those two things in their minds, people on the one hand were apt to say, when they heard that a certain educational institution was to be assisted by Government, "What an excellent, benevolent Government it is: how anxious to encourage education." But when, on the other hand, it was said that those grants so largely increased the Civil Service Estimates as to render it necessary to put on an additional 2d. of income-tax, the observation made was, "What an extravagant Government this is to go on taxing us without stint to indulge some visionary object of benevolence." It was therefore well, he thought, not to raise this question too much, and the Government must surrender the praise of being the most benevolent Government in the world, with a great many parental feelings for the children of the State, in order not to incur the blame of being a Government so extravagant that it placed undue burdens upon the people. This brought him back to the old text—that here as well as in Mechanics' Institutes—in the National Schools, in the British and Foreign School Society, and in that with which the Vice-Chancellor had to deal—the Charitable Trusts of the country—there should be an endeavour to make all these work for the improvement of the people, rather than to trust to assistance from Government. He believed that plan in the end would answer best, for he felt sure that everybody would be far better satisfied, because all would feel that, whatever good was done was due to themselves, and not to extraneous aid. He thought the plan adopted here, of having those various societies connected with one central Institution, was likely to be very beneficial, and he believed that introducing these young men to the Examinations, and giving them certificates and prizes, was a most important means of improving the education of the people. Let him say one thing more with regard to the general effect of these exertions. Every person with whom he had spoken of late years on this subject, and even up to the present moment, told him that there were a number of skilled workmen in this country whose wages were very high, who earned from 15s. to 20s. and 30s. per day, but whilst their skill as workmen was admirable, and whilst the reward was commensurate with that skill, they did not find that their restraint over their physical appetites, or that their moral elevation was at all commensurate with their skill in their callings. There were too many of them, who, having in two or three days' work in a week earned a very large sum, instead of putting by a portion—instead of clothing better the members of their families—instead of buying books that might be useful as well as entertaining—spent the whole of that sum in physical enjoyments; and when the day or the year of distress arrived, many of them were selling the furniture of their houses, and obliged often to resort to the poor-house for their daily subsistence. The only way in which to cure this great evil, which they must all lament, was to give them objects, to give them thoughts, to give them occupations of mind, which would teach them that there was something better—that there were duties to be performed which must not be neglected—that there were restraints to be put upon the passions, which religion and morality must enforce upon every well-constituted mind; and, finally, to convince them that if their minds were cultivated their whole condition would be improved, they would have reason to feel greater independence—reason to feel themselves as being raised in the scale of existence—as being more fit to perform their duties in this life, and to appear before their Creator in the next. He believed that all educational efforts tended to that end; and feeling that this Society was engaged in an important work, he desired to give it his cordial support.

The Chairman said it was his duty, in closing the discussion, to invite the meeting to give their thanks to Mr. Chester for the paper with which he had favoured them. He was sure they would all agree with him that he was entitled to their thanks, not only on account of the nature of the paper itself and the subject brought before them, but also for the special way in which he had treated it, and which had drawn forth so interesting a discussion as that which they had just listened to. Mr. Chester had drawn their attention to many of the difficulties of this subject. He (the Chairman) was not going to occupy their time by discussing again those difficulties, but he might be permitted, in summing up, to call their attention to one or two of them. In the remarks they just heard, they had had the true answer to those who would say that Mechanics' Institutes and such institutions as they were now considering had anything of an irreligious tendency. That man was raised in the social scale, and better able to perform his duties as an immortal being, by such teaching as he there received was, he believed, now generally acknowledged. He was, however, afraid of some little misunderstanding as to one or two remarks that had been made on this subject. Indeed, he was not sure that the remarks of Mr. Chester himself might not lead to misapprehension of the objects of these Institutions; and, perhaps, the observations of the learned Vice-Chancellor, which he cordially agreed with in the main, might be liable to some misunderstanding also. It was no part of the arrangements of the Society of Arts to exclude from fellowship with it those numerous institutions which held this opinion—that even in Mechanics' Institutes there ought to be a distinct religious education. This Society wisely opened its doors to all attempts which were made to educate and improve young men after they had left school. They wished that all should work upon their own principles; and he, for one, holding rather strongly that all education ought to be founded upon a religious basis, was quite content to leave this to be proved by the results of the various experiments that were being made. In the list which had been shown him of the persons who had distinguished themselves in the Examinations of this Society, he had been struck with the fact that several of them came from the Young Men's Christian Institutes, and some from the Evening Classes at Crosby Hall; all of which, as they knew, were conducted upon distinctly religious principles; not that they were the better perhaps for that, because, after all, the religion of a society did not consist in the particular religious creed which it professed, but in the personal religion of its members, and he believed the best plan was to assist all honest and hearty efforts, whether made upon one principle or the other; and he was sure that ultimately the best system would prevail. There was another point upon which some misconception might perhaps arise. There seemed to be some little dispute, if he might use the term, between two persons so eminent in the cause of education as Mr. Chester and Sir James Shuttleworth, as to whether they ought to encourage teaching in evening schools in the places used for day schools, or whether they ought not rather to uphold the Mechanics' Institutes as a means of adult education. For his own part he believed there was full room for both. His own experience in the north led him to think that there was a real difficulty which had not yet been adverted to, but which ought not to be passed without notice, namely, that there were two sets of persons who received this adult education, and it was not easy to bring them together. Those who worked at a manual occupation all day in their fustian jackets, had a distaste to being brought into juxtaposition in the instruction-room with those whose lighter occupation and better salaries enabled them to be better dressed. There would always be a difficulty in bringing the two classes together in carrying on the work of education, and he thought this was a point which should be attended to in the consideration of the subject of adult instruction. There was one more point to which he would allude. As to the instruction given, he thought the failure in some institutes had been occasioned by giving too much prominence to lectures. He thought it was better to give instruction which partook more of the character of the education imparted in the colleges and higher classes of schools. Upon the subject of prizes for successful examinations, he thought the mere certificate of merit was not of much value. What they must do, was to show that some palpable benefit as to a man's future career resulted from the examinations. With regard to government patronage he thought the placing at the disposal of the Society a few nominations to compete for appointments was likely to exert a very inconsiderable influence, and certainly one not to be dreaded. It now only remained for him to propose that those present should tender their hearty thanks to Mr. Chester for the interesting paper he had read.

A vote of thanks was then passed to Mr. Chester.

The Secretary called attention to specimen of a material called the Gishurst Compound, which has been found efficacious for preventing and destroying the red spider and other insects found in plants. Specimens of bread, entirely made by machinery, were also placed on the table. An account of the process will appear in a future number of the *Journal*.

The Secretary announced that on Wednesday evening next, the 23rd inst., a Paper by Mr. John Leighton, F.S.A., "On the Library, Books, and Binding, particularly with reference to their Preservation and Restoration," would be read.

GIANT TIMBER.

The following is extracted from the *Builder*:—

Our attention has been called to an importation of three cargoes of mast-pieces of timber now discharging in the Commercial Docks, Rotherhithe. The sizes both in length and square, are so unexampled as to be worthy of record. One vessel, indeed, the Bostonian, of 1,000 tons, has spars of a magnitude that we believe were never before made timber of commerce; they run from 90 to 140 feet in length, and from 26 to 40 inches square. One mast contains 28 loads, weighing about 33 tons, and is (as are most of them) nearly as straight as a ruler, and without a knot; being 139½ feet long and 39½ inches square. When felled, it measured 316 feet to the branching top, and for 150 feet was without any branch at all. It was squared to 41 inches; but was of necessity reduced to 31½ inches to admit of its entering the ship's bowport. The quantity of timber in this enormous tree is worthy of notice; call it 300 feet by 41 inches square, it would contain 3,502 cubic feet, or 70 loads 2 feet as squared, or 116 loads as round timber. It would saw into 2,050 boards 41 inches wide, half an inch thick, and 12 feet long; or, allowing about twelve per cent. for waste in sawing, 1,800 boards 36 inches wide, half an inch thick, and 12 feet long. If laid out quite close it would cover 72,000 square yards, or 1 acre, 1 rood, 2 chains, 6 poles, 19 yards; or, allowing for unavoidable interstices, about two acres and a quarter. It is difficult to imagine a tree half as high again as the Monument before it branches out. These masts are considered worth £12 to £14 per load, and we understand are secured for the British navy; and it is said that the longest may perhaps be raised as a flag-staff at Windsor. We are indebted for these particulars to Mr. N. Gould, F.S.A.

JAPANESE COINS.

The following results of an authorised assay of Japanese coins will be interesting at the present time, considering the intercourse which has been recently opened up with that country:—

	No.	Weight in decimals of an ounce troy.	Proportion in 10,000 parts		
			of Gold.	of Silver.	of Base alloy.
Copangs	1	·3621	5,680	4,310	10
	2	·3626	5,670	4,320	10
	3	·3658	5,668	4,325	7
½-Copangs	4	·1826	1,910	8,046	44
	5	·1820	1,986	7,980	34
⅛-Copangs	6	·0532	2,949	7,016	35
	7	·0535	2,970	7,016	14
	8	·0537	2,981	7,010	9
	9	·0534	2,969	7,005	26
	10	·0530	2,922	7,034	44
	11	·0534	2,982	7,010	8
	12	·0535	3,026	6,970	4
	13	·0539	3,142	6,854	4

The values of the metals in each coin are, on an average, as follows:—

	Copangs.		½-Copangs.		⅛-Copangs.	
	S.	D.	S.	D.	S.	D.
Gold	17	6 ·225...	3	0 ·228...	1	4 ·307
Silver	0	10 ·181...	0	9 ·575...	0	2 ·424
Intrinsic Value..	18	4 ·406...	3	9 ·803...	1	6 ·731

Calculated at the Mint Price of Gold, £3 17s. 10½d. per ounce, and of Silver £0 5s. 0d. ditto.

Home Correspondence.

SIR,—In reporting my observations on Mr. Simmonds' paper on the Utilisation of Waste Substances, I am made to say, that a German gentleman took out a patent for producing paper from leather waste, and that "the plan was to remove every substance except the *gelatine*." Now, what I really said was, that a German gentleman, named Lichtenstadt, took out a patent in the latter part of the year 1857, and that his plan was to remove every substance except the *fibrous* material, which he then converted into pulp in the usual way, and which might be used with rags, or other paper-making material, or alone.

The patent, I find, is numbered 2,426 A.D. 1857, and the specification will, doubtless, be found amongst the publications of the Commissioners of Patents in the reading-room of the Society.—I am, &c.,

F. W. CAMPIN.

Feb. 12, 1859.

ELECTRO-ZINC DEPOSITS UPON ENGRAVED COPPER-PLATES.

SIR,—M. Joubert would appear, by his communication on this subject last week, to have overlooked the fact of the intimate union of these two metals when brought into chemical contact, whereby a brass is produced, sometimes of great hardness.

The copper tool used in soft soldering zinc becomes often so hard as to strip off the teeth of a good file when applied to dress the point of the tool, which soon becomes unserviceable on such work.—Yours, &c.,

HENRY W. REVELEY.

ALUMINIUM.

SIR,—I have read in the *Journal of the Society of Arts*, of February the 4th, the interesting paper which you delivered before the members of that Society on the 2nd inst., and the discussion which followed. And I send the following, believing it will explain the apparent discrepancy, which was noticed by Mr. Thompson, between my statement and that of M. Figuier.

In my paper, read before the College of Dentists, on the 5th of last October, I stated, that "cast" aluminium, when disconnected with other metal, will stand the action of the saliva of the mouth upon it; but that "wrought" aluminium will not stand that action. Therefore, if the mouthpieces for musical instruments (spoken of by M. Figuier) were made of "wrought" metal I can readily understand that they would be chemically affected by the action of the saliva of the mouth, as that gentleman describes. Or if they were made of "cast" aluminium, and connected with an instrument made of any other metal, so that the saliva of the mouth could act upon the two metals in connection, a galvanic action would ensue, and the oxidation of the aluminium mouthpiece be the result. But if a musical instrument could be made entirely of "cast" aluminium, mouthpiece included, such would not be the case. Or if a "cast" aluminium mouthpiece were attached to a wooden musical instrument it would not be liable to oxidation.

The mouthpiece referred to by M. Figuier, if attached to a metal musical instrument, would be acted upon by the saliva of the mouth in a similar way to artificial teeth with side springs, as described in my paper already referred to; consequently, there is a perfect agreement between that gentleman's statement and that which I had previously advanced.

Those dentists who have tried aluminium as a basis for artificial teeth have failed, because they have confined themselves to the use of "wrought" metal instead of "cast," which, as I have before stated, will not stand the action of the saliva upon it; whereas "cast" aluminium will. And it is only in consequence of my having used "cast," instead of "wrought," aluminium that I have been successful in bringing it into use for dental purposes.

You speak of aluminium having been used instead of gold for stopping teeth. But it must from necessity become "wrought" metal by being beaten into leaves, or, if it could be cast sufficiently thin, the very act of compressing it into the cavity would render it wrought metal and destroy its property of chemical resistance.

M. St. Claire Deville is mistaken in saying that water at any temperature will not effect aluminium. I do not think cold water does affect it, but if it be boiled in water for some time its surface becomes covered with a black oxide; so far as my experience goes, however, water must be very hot to effect this change upon it.

Mr. Thompson also spoke of my using tortoiseshell to insulate the spring work. I did so at first, but am now using insulating mineral tubes, which are cast in the piece; these I find to be more effective and simple. I have now been wearing in the mouth a piece mounted in aluminium constantly night and day since the middle of December, 1857—nearly fourteen months—without any visible alteration; therefore I have every confidence in its durability; but its perfect tastelessness, harmlessness, and extreme lightness, are its great recommendations for dental purposes. I am, &c.,

G. F. HARRINGTON.

Ryde, Isle of Wight, Feb. 5, 1859.

Proceedings of Institutions.

Halifax Mechanics' Institution. — A numerously attended *soirée* took place at this Institution on Tuesday, the 14th December, at which Sir Charles Wood, M.P., presided. In opening the proceedings, he said he desired to express the deep interest he had always taken in such institutions. He thought that it could not but have struck even the most casual observers, to what an extent during the past autumn the topic of popular education had occupied the attention of the people of this country. Meetings had been held in Liverpool, Manchester, York, and other places, attended by people showing the liveliest interest in the subject, and addressed by persons of great eminence and distinguished by their talent, their position, and their intellectual acquirements, who had spoken with a zeal and earnestness which had not been witnessed at any former period. After speaking of the rapid advance that had been made during the last few years in the work of political improvement, he remarked upon the extent to which the ablest, most energetic, and most active friends of the people in this country had directed their attention particularly to the improvement of that which concerns the bodily welfare of the people—the improvement of their dwellings, the improvement of the drainage of their towns, the supply of water, and all those matters which improved the physical condition of the people, at the same time taking the greatest pains to form Mechanics' Institutions and other similar societies for the improvement of the education and the mental culture of the great body of the people. He thought this was a proof that in England they were determined to carry forward, in every respect, that system and that progress which he hoped would raise them all in time to a much higher point of civilisation and cultivation than they at present enjoyed. The spread of education, so far from promoting the separation of the various classes of society would tend to unite them, promoting the happiness of all sections of the community, from one extreme of the social scale to the other. He thought, moreover, that whatever might be the national system of education, whether it were fuller or more complete than at present or not, there was ample scope as well as a great call, for institutions like the present. Sir Charles then pointed out the importance of the acquirement of foreign languages, for which that institution would afford facilities, and defended the introduction of a high class of light literature into the library. He urged the importance of the constant perusal of the daily press, saying that he believed it was perfectly necessary that in a free country like this all the intelligent portion of the community should have access to papers of every description and advocating all classes of opinions. He had no fear of any mischief that might be done by publications of that kind. He had the most perfect confidence in the good sense and judgment of the people of this country, and though there might be some mistaken and misled for a time, yet, if they had an opportunity of seeing both sides, the result, he had not the least doubt, would eventually be a sound, good, and correct judgment. He concluded by assuring the assembly that it had afforded him much pleasure to take part in the proceedings of the evening, and that it was his wish to see such institutions extended as far as possible, because he believed they were likely to assist in raising the people of this country to that point of civilization, and moral and intellectual, as well, he hoped he might add, as of religious improvement, to which it was to be desired that they might ultimately attain. Mr. Frank Crossley, M.P., and other gentlemen afterwards addressed the meeting.

Sheffield Church of England Educational Institute. —The report for last year states that the numerical attendance has been unprecedentedly large. The highest number of names on the books, in any quarter of the year 1857, was 251. In the first quarter of the present year, the number was 264; in the spring quarter it was 202; in the autumn quarter, now closing, it reached 464. This last record, high as it is, is however not to be regarded as representing the whole number desirous of becoming students in the last quarter. The overcrowded state of the rooms, and the unmanageable size of the classes, rendered it necessary to give notice, through the newspapers, that no more could be admitted. It is evident that the expansion of the Institute's operations is limited solely by lack of money and lack of room. There appear to be plenty of men willing to teach, and of people longing to be taught; what the Institute wants is, plenty of money to enable it to provide suitable means for their instruction. It is estimated that for £2,000 a handsome building might be erected on some vacant ground in St. James's-street, which would not only afford ample accommodation for the classes, but also contain a large lecture room, capable of seating 400 persons; and it is proposed that this building should be devoted to religious and educational purposes, in connexion with the Church of England in Sheffield. The degree to which, during the last three years, the number of teachers and the range of subjects have increased is most remarkable. Three years ago the Institute began with twelve classes, conducted by nine teachers. The number of subjects was eleven. It has now sixty-five classes, conducted by nearly seventy teachers, among whom are ten gentlemen of learned professions. There are classes for the study of the Bible, the Greek Testament, the Latin Classics, French, German, Arithmetic, Book-keeping, Euclid, Algebra, Trigonometry, Chemistry, and the Physical Sciences generally. History, Geography, and Political Economy are taught on the advanced methods suggested by the Society of Arts; while there are also Classes in Grammar, Composition, Definition of Words, and General Literature. There is an Elocution Class, as well as classes for Singing and Shorthand. The report says that such of the students as are engaged on the higher subjects, are working with a view, immediate or remote, to the Examinations of the Society of Arts. The Library continues to be a source of much interest, more than 2,500 volumes having been taken out during the year.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered during the Vacation 1858.

411. Railway and Canal Legislation—Report and Evidence.
445. County Courts—Return.
478. Stipendiary Judges—Return.

512. Registry of Deeds (Dublin)—Treasury Minutes.
523. Mauritius—Returns.
524. Vancouver's Island—Return.
527. Army Prize Money—Account.
487. Manchester Model Secular School—Correspondence.
507. Paper—Returns.
515. Metropolitan Board of Works—Report.
68 (VII). Trade and Navigation Accounts (31st July, 1858).
362. Accidents on Railways—Report.
452. Friendly Societies—Report of the Registrar.
464. Education—Return.
481. Hong Kong—Return, Part 1.
518. Colonels—Return.
521. Chinese, &c. Emigrants—Return.
416. East India (Railways)—Report.
486. East India (Territorial Revenues and Disbursements)—Accounts.
522. New England Company—Return.
385. Railway and Canal Companies—Return.
505. Oxford University—Copies of three Ordinances.
382. East India (Transport of Troops)—Report and Evidence.
441. Savings' Banks—Report and Evidence.
344 (1). Harbours of Refuge—Supplemental Appendix and Index.
401. Land Transport Corps—Report and Evidence.
461. Colonization and Settlement (India)—4th Report.
98 (A VI). Poor Rates and Pauperism—Return (A).
495. Income Tax, &c. (London)—Return.
431. Railways—Returns.
488. Steam Vessels—Return.
489. Newspapers, &c.—Return.
398. 418, 438. Contracts (Public Departments)—3, 4, and 5 Reports.
442. River Thames—Report and Evidence.
412. Destitution (Gweedore and Cloughnaheely)—Report and Evidence.
498. Army (Purchase of Commissions)—Return.
499. Courts Martial—Returns.
501. Land Registry Offices—Returns.
429. Stade Tolls—Report and Evidence.
68 (VIII). Trade and Navigation Accounts (31 August 1858).
490. Civil Service Commission—Return.
98 (A VII). Poor Rates and Pauperism—Return (A).
513. District Union Schools—Return.
381. Bank Acts—Report and Evidence.
491. Assessed Taxes—Account.
413. Tribunals of Commerce—Report and Evidence.
474. Navy and Army—Detailed Accounts of Receipt and Expenditure.
520. Boots (Army)—Return.
387 (1). Divine Worship in Populous Districts—Index to Lords' Report.
68 (IX). Trade and Navigation Accounts (30th September, 1858).
492. Property and Income Tax—Return.
482. Consular Service and Appointments—Report and Evidence.
98 (B). Poor Rates and Pauperism—Return (B).
63. Population, &c. of Parishes—Return.
98 (A VIII). Poor Rates and Pauperism—Return (A).
380. Woods, Forests, and Land Revenues—36th Report of the Commissioners.
473. Health of the Royal Navy—Statistical Report.
519. Flogging (Army)—Return.
450 (1). Proceedings on Private Bills—Index to Lords' Report.
68 (X). Trade and Navigation Accounts (31 October, 1858).
98 (A IX). Poor Rates and Pauperism—Return (A).
416 (1)—East India (Railways)—Index to Report.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Rev. Henry Christmas, "On Shakespeare's Historical Dramas."
British Architects, 8.
Medical, 8.
United Service Inst., 8½. Mr. R. Taylerson, "On Taylerson's Diagonal Principle of Iron Shipbuilding."
TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8.
Medical and Chirurg, 8.
Zoological, 9.
WED. ......United Service Inst., 3. Mr. F. A. Abel, "On Gunpowder: its Manufacture in England and on the Continent, and on the Means employed for its Ignition."
London Inst., 3. Mr. P. W. Brayley, "On Meteorology."
Society of Arts, 8. Mr. John Leighton, "On the Library, Books, and Binding, particularly with reference to their Preservation and Restoration.
Geological, 8.
Archæological Assoc., 8½.
THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Philosophical Club, 5½.
London Inst., 7. Mr. George Scharf, jun., "On Early Christian Art, as Exhibited in the Catacombs and Churches of Italy.
Numismatic, 7.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
FRI.........United Service Inst., 3. Admiral Fitzroy, "On Meteorology."
Royal Inst., 8½. Prof. Faraday "On Schonbein's Opposite Oxygens."
SAT. ......London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February* 11, 1859.]

Dated 22nd December, 1858.

2920. R. Clegg, Islington, F. Angerstein, Kennington, and G. Ferry, Hackney—Improved mechanism for imparting reciprocating motion to machinery, and more especially pumps.
2924. M. Renney, Queen-street, Dublin—Imp. in bridges.

Dated 8th January, 1859.

68. E. Cobbold, Hendon, Middlesex—Imp. in instruments for writing and marking, and for the preparation of certain substances for conversion into instruments for writing and marking, and for the application to useful purposes of certain products, arising from preparation aforesaid.

Dated 19th January, 1859.

160. P. A. Sparre, 50, Chancery-lane—Imp. in the manufacture of paper, suitable for bank-notes, cheques, bills, and similar articles.

Dated 21st January, 1859.

190. C. O'Hara, 4, Upper Seymour-street, Hyde-park—Imp. in propellers, for propelling steam-boats, ships, and vessels.

Dated 22nd January, 1859.

202. B. Templar, Bristol—Imp. in umbrellas and parasols.
204. M. Henry, 84, Fleet-street—Imp. in machinery or apparatus for manufacturing corks and bungs.
206. T. W. Rammell, 16, Spring-gardens—Imp. in atmospheric propulsion, and the structures, tubes, machinery, and apparatus applicable thereto.
208. R. Barter, St. Ann's-hill, Blarney, Cork—Imp. in heating and ventilating buildings, and in apparatus connected therewith.

Dated 24th January, 1859.

209. W. C. Homersham, Adelphi-terrace, Strand—Imp. in floating gridirons or stages for repairing ships or other vessels.
210. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of cast steel and iron.
211. R. Mushet, Coleford, Gloucestershire—An imp. in the manufacture of cast steel.
212. R. A. Brooman, 166, Fleet-street—Imp. in pumps. (A com.)
213. J. Laubereau, Paris—Imp. in air engines.
214. J. Smith and W. H. Smith, 8, Upper Fountain-place, City-road—Certain imp. in manufacturing paper, and in producing watermarks, patterns, figures, letters, and devices thereon, and in the construction of the mechanism employed therein.
215. J. Savory and W. R. Barker, 143, New Bond-street—Imp. in bottles for medicines and poisons.
216. J. Fowler, jun., Cornhill, R. Burton, Kingsland, Middlesex, D. Greig, New Cross, Kent, and J. Head, Newcastle-on-Tyne—Imp. in agricultural implements, and in apparatus used for hauling agricultural implements by steam power.
217. A. Warner, 31, Threadneedle-street, and W. Tooth, Sumner-street, Southwark—Imp. in the manufacture of iron and gases for such and other uses.
218. J. Proger, 13, Trinity-street, and D. Davies, Stuart-street, Bute Docks, Cardiff—Imp. in lanterns used on board ship to signal to the steersman.
219. Right. Hon. James, Earl of Caithness, Hill-street—Imp. in parts of the permanent way of railways.
220. M. Swan, Henstridge-villas, St. John's-wood—Imp. in ballasting ships, applicable also to the extinguishing fires on board ships.
221. W. Tasker, jun., Waterloo Iron Works, near Andover, Hants—Imp. in ploughs.

Dated 25th January, 1859.

223. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in machinery or apparatus for cutting and shaping wood. (A com.)
224. R. Bodmer, 2, Thaives-inn, Holborn—Improved resin and resinous substances. (A com.)
225. W. Cutts, Oldham—Imp. in the manufacture of bobbins, spools, and cop tubes, and in the machinery employed therein.
226. W. Hodgson and H. Hodgson, Bradford—Imp. in machinery or apparatus for preparing and spinning wool and other fibrous substances.
227. J. White, Finchley, Middlesex—Imp. in means or apparatus to facilitate respiration under water, or under the influence of fire, or in other situations where an artificial supply of air may be required, part of which improvements is also adapted to facilitate movement in or upon the surface of water.
228. W. Andrews, 30, Cornhill—Imp. in electric telegraphs.
229. F. J. Jones, Aldermanbury—An imp. in shirt fronts.
230. H. Brecknell and J. Dyer, Bristol—Imp. in cocks and valves.
231. I. Woodcock, Commercial-street, Spitalfields—Imp. in barometer and thermometer dials.
232. B. J. Spedding, 9, Cross-street, Birkenhead—Imp. in apparatus for generating and regulating gas, and for impregnating the same with volatile hydro-carbon fluids.
233. C. G. Kelvey and W. Holland, Rock Ferry, Birkenhead—An improved escapement for chronometers and other time-keepers.

234. W. E. Newton, 66, Chancery-lane—An imp. in life preserving vests. (A com.)

Dated 26th January, 1859.

235. W. R. Alexander, Glasgow—Imp. in furnaces and apparatus for the manufacture of sugar, and for the consumption or prevention of smoke.
236. I. Hammond, Winchester—Imp. in breech-loading fire-arms, and in cartridges to be used therewith.
237. O. Hussey, Baltimore, U.S.—Imp. in the construction of ships' blocks.
238. D. Graham, Wapping, Middlesex—An improved method of driving centrifugal machines. (A com.)
239. J. Wells, Keighley, near Yorkshire, and W. Crouch, Sutton, near Keighley—An improved coupling for railway carriages and analogous uses.
240. F. C. C. Paulsen and A. Alsing, Emmett-street, Limehouse—Imp. in preparing beverages usually called punch.
241. M. Fernandez, 2, Devonshire-square, Bishopsgate-street Without—Imp. in straw and hay cutters.
242. J. Kerr, 17, Bedford-terrace, Trinity-square, Southwark—Imp. in the construction of revolving fire-arms.

Dated 27th January, 1859.

243. J. Mercer, Liverpool—Imp. in the process of currying leather. (A com.)
244. W. Ager, Rhorsburg, U.S.—Imp. in machinery for cleaning rice.
245. T. Hartshorne, West Bromwich, Staffordshire—An improved metal to be used for making journey brasses for mills, rollers, forges, and all kinds of shafts and machinery, and also for shipping and for bearings for shafts and journey brasses in general.
246. E. Dixon and H. Whittaker, Preston—Imp. in apparatus used in weaving textile fabrics.
247. J. Meacham, Birmingham—Imp. in pens and penholders.
248. H. D. P. Cunningham, Bury, near Gosport—An imp. in the rig of ships or vessels.
249. H. Rawson, Leicester—Imp. in machinery for preparing wool and other fibrous substances.
250. J. Buckingham, Walworth-common, Surrey, and G. Salt, Saltaire, near Bradford—Imp. in the construction and adaptation of drawing and other rollers employed in drawing and compressing fibres, which improved construction of rollers is also applicable in compressing fabrics.
251. E. T. Hughes, 123, Chancery-lane—Imp. in the manufacture of biscuits. (A com.)
252. G. F. Bradbury, Oldham, and J. J. King, Glasgow—Imp. in certain apparatus applicable to sewing machines.
253. W. Crowther, Leeds—Imp. in the manufacture of prussiate of potash or soda, and in recovering a useful material therefrom.
254. J. Gathercole, Bath-terrace, Camberwell New-road—Improved machinery for manufacturing envelopes and paper bags.

Dated 28th January, 1859.

255. I. Zacheroni, Liverpool—An improved mode or method of preventing the escape of smoke into the atmosphere, and in the construction of chimney "pots" or "tops" for curing smoky chimneys.
256. W. Robertson, Manchester—A new apparatus for propelling boats on canals, rivers, and lakes of moderate depth.
257. G. Bartholomew, Linlithgow, N.B.—Imp. in shoes for horses and other animals requiring such shoes, and in the means of attaching the same to the feet.
258. C. E. Amos, the Grove, Southwark, and J. Francis, Bangor, North Wales—Imp. in water pressure engines, and their application to pumping machinery.
259. F. Prince, 138, New Bend-street—A new breech-loading gun.
260. W. Yates, Mary-street, Bromley—Imp. in turnaces.
261. R. Griffiths, 69, Mornington-road—Imp. in regulating the pressure of steam in steam-boilers, and in preventing the accumulation of deposit therein. (Partly a com.)
262. H. Watson, High Bridge Works, Newcastle-upon-Tyne—Imp. in the manufacture of Knotter-plates, used in the manufacture of paper.
263. A. Barclay, Kilmarnock, Ayr, N.B.—Imp. in obtaining and distributing or applying electricity and magnetism.

Dated 29th January, 1859.

264. L. Leisler, Glasgow—Imp. in extracting metallic copper from the pyrites residuum of vitriol works, and from other substances. (A com.)
265. J. Lane, West Bromwich, Staffordshire—New or improved machinery for the manufacture of screws, and for tapping nuts for screws.
266. J. MacKenzie, Saint Martin's-le-Grand—An improved method of operating ventilating valves, especially applicable to ventilating gas burners.
267. J. Marino, Stockholm—An inodorous closet or commode.
268. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in apparatus applicable to measuring, regulating the pressure of, and consuming gas for illumination. (A com.)
269. H. Grissell, Regent's Canal Iron Works, Eagle Wharf-road—Imp. in machinery for moving ships or vessels on slips or inclined ways.
271. J. Meacham, Birmingham—Imp. in apparatus for clasping and closing books, purses, reticules, and other similar articles, and for retaining and securing paper documents, letters, bills, and other memoranda.

Dated 31st January, 1859.

272. T. P. Smith, Stanmore, Middlesex—An apparatus for guiding or directing the pen or pencil in writing or drawing.
274. J. Raywood, Wentworth, Yorkshire—Certain imp. in the construction and method of working sewing machines.
276. J. Robertson, Glasgow—Imp. in details, by which motive force is transmitted in machinery.
278. J. P. Booth, Cork—Imp. in ventilating ships.

Dated 1st February, 1859.

280. J. Grimond, Manchester—Imp. in the manufacture of hearth rugs.
282. J. Hosking, 5, Catherine-terrace, Gateshead-on-Tyne, and T. Cock, Cleator-Moor, near Whitehaven—Imp. in furnaces or fire places.
286. M. A. Walker and R. Walker, Birmingham—Certain imp. in the manufacture of percussion caps, and in the apparatus for effecting certain parts of the same.
288. T. P. Purssglove, Battersea, Surrey—Imp. in barometers.
292. C. Crockford, Holywell, Flintshire—A mode or method of producing metallic sulphates.
264. E. H. Bentall, Heybridge, near Maldon, Essex—Imp. applicable to machinery for grinding or pulverizing various substances.

Dated 2nd February, 1859.

296. E. E. Allen, Brompton-row—Imp. in stereoscopic apparatuses.
298. R. Lancaster, Orrell, near Wigan—An improved mode of ventilating coal and other mines.
300. J. R. Cooper, Birmingham—Imp. in breech-loading fire-arms.
302. J. Buncher, Birmingham—Imp. in the manufacture of eyes or fastenings for stair rods.
304. J. Hirst, jun., and J. Hollingworth, Dobscross, Saddleworth, Yorkshire—Imp. in the construction of power looms.
306. H. F. Kemp and W. Skey, Root Distillery, Louth, Lincolnshire—An improved food for cattle.

INVENTION WITH COMPLETE SPECIFICATION FILED.

325. J. M. E. Masson, Rue des Fossés, St. Thomas Evreux, France Imp. in apparatus to facilitate working under water.—4th February, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Feb.* 8, 1859.]

February 8th.
1812. T. G. Messenger.
1839. A. J. Paterson.
1847. F. J. Manceaux.
1931. J. H. Johnson.
1947. W. Kempe.
1969. J. H. Johnson.
1973. M. A. F. Mennons.
2003. A. Guye.
2057. W. E. Newton.
2187. M. Hipp.
2411. W. Hall and A. Wells.
2653. T. Spencer.
2757. W. Robertson and J. G. Orchar.
2905. J. Soutter.
2953. M. A. F. Mennons.
2957. J. Shaw.

[*From Gazette, February* 11, 1859.]

February 11th.
1824. J. T. Pitman.
1826. R. C. Gist.
1840. R. Jobson.
1842. R. Jobson.
1844. R. Jobson.
1845. W. B. Nortcliffe.
1848. C. L. Light.
1850. J. Petrie, jun.
1851. T. Worth and H. Spencer.
1855. J. Cartmel.
1857. J. Holt.
1858. J. Smith and S. A. Chease.
1860. S. C. Lister and J. Warburton.
1879. J. Luis.
1885. A. Pilbeam.
1918. W. H. Harfield.
1954. J. D. Brabazon.
1988. A. V. Newton.
2001. G. T. Bousfield.
2111. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.
2321. C. West.
2633. C. F. Vasserot.
2701. C. Burrell.
2720. C. Bedells.
2776. E. A. Servier.
2839. G. F. Wilson.

[*From Gazette, Feb.* 15, 1859.]

February 15th.
1866. P. E. Chappuis.
1868. L. A. Herrmann and E. I. E. Herrmann.
1872. W. E. Evans.
4875. J. Norton.
1876. F. Shaw.
1901. F. F. Delpy.
1993. G. Price and W. Dawes.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, Feb.* 8, 1859.]

February 4th.
416. S. F. Cox.
February 5th.
310. M. L. Parnell.
327. J. E. Duyck.
343. J. Elce and S. F. Cottam.
354. W. H. Harfield.
358. G. T. Bousfield.

[*From Gazette, Feb.* 11, 1859.]

February 7th.
452. J. S. C. Heywood and G. Lloyd.
February 8th.
356. H. Bessemer.
359. R. A. Brooman.
February 9th.
345. J. W. Duncan.
366. S. Fox.

[*From Gazette, Feb.* 13, 1859.]

February 11th.
363. J. Mills.
380. W. McFarlane.
385. E. Morewood & G. Rogers.
403. H. J. Hyams.
405. A. V. Newton.
February 12th.
390. E. Deiss.

Journal of the Society of Arts.

FRIDAY, FEBRUARY 25, 1859.

EXHIBITION OF 1861.

The following letter has been addressed to the Chairman of Council of the Society of Arts:—

17, Montague-place, 16th Feb., 1859.

Dear Mr. Dilke,—I send you a somewhat hasty reply to the inquiry you made of me, whether any data can be obtained from the results of past Exhibitions to justify a confident expectation that if the Exhibition of 1861 be properly organized—receive the cordial support of Her Majesty and Prince Albert—be supported by the Royal Commissioners of 1851,—and be liberally supported by home and foreign Exhibitors, its success will equal or surpass that of 1851.

Before we enter into details, let us first glance at the progress of Exhibitions generally.

The most striking instance is that of the Quinquennial Exhibition at Paris.

Here we find for a long series of years, that an Industrial and Fine Art Exhibition has attracted on each recurring period more visitors and more Exhibitors. No doubt then can exist that this period has been wisely chosen for France. The progress has been thus—

In 1789 there were	110	Exhibitors.*
,, 1827 ,, ...	1795	,,
,, 1855 ,, ...	9799	,,

Next let us refer to the progress of an Annual Exhibition at home, which has now been held for some years, viz., that of the Royal Agricultural Society:—

In 1844, at Southampton there were	2432	Visitors.*
,, 1851, at Windsor ,,	3397	,,
,, 1858, at Chester ,,	6187	,,

By this we see that each Annual Exhibition here, as each Quinquennial one has done in Paris, attracts more visitors and more exhibitors than its predecessors, and this no matter where the meeting is held, every part of the country showing an equal anxiety to take advantage of the information to be gained at such meetings.

Next let us examine into the facts connected with the Exhibition of 1851, and the minor and local Exhibitions which have followed it at a very humble distance, and then we shall be in a position to arrive at a fair inference as to the probable result to be anticipated from an Exhibition in 1861.

First we will place together the facts we have collected in a tabular form, thus—

	Visitors.	Receipts.	Population.	Price of Tickets and Number Issued.	Amount Realised.	Season Tickets and Amounts Realised.
LONDON—					£.	
Daily Admissions...	5,265,429	£356,278	2,300,000	£1 0s. 0d. ... 1042	1,042	No. 25,605
Season Tickets ...	773,766	£67,514		5s. 0d. ... 245,389	61,347	£67,514
				2s. 6d. ... 579,579	72,447	
				1s. 0d. ...4,439,419	221,971	
PARIS	4,593,576	£128,099	1,200,000	5f. ... 33,926	6,735	
				2f. ... 95,688	7,663	
				1f. ...2,097,607	83,904	
				4 sous ...2,182,433	17,459	
DUBLIN—						
Daily Admissions...	634,523	£28,981	254,000	5s. 0d. ... 2,225	556	No. 10,500
Season Tickets ...	366,745	£18,382		2s. 6d. ... 31,722	3965	£18,238
				1s. 0d. ... 422,965	21,148	
				0s. 6d. ... 132,457	3311	
CORK—						
Daily Admissions...	74,095	£2,874	86,000	2s. 0d. ... 6022	602	No. 1,474
Season Tickets ...	54,936	£1,545		1s. 0d. ... 18,937	946	£15,45
				1s. 6d. ... 1018	76	
				0s. 6d. ... 48,118	1203	
BIRMINGHAM	80,882	£3632	173,000	5s. 0d. ... 1339	335	
				2s. 6d. ... 195	24	
				1s. 0d. ... 51,609	2580	
				0s. 6d. ... 27,739	693	
MANCHESTER—						
Daily Admissions...	1,053,538	£60,506	340,000	2s. 6d. ... 131,608	16,451	No. 12,357
Season Tickets ...	283,177	23,014		1s. 0d. ... 856,256	42,812	£23,014
				0s. 6d. ... 65,674	1641	

The first fact we deduce from this table is the proportion the total number of visitors bears to the population of the places where the Exhibitions were held. These numbers are—

For London	2·62	visits to 1 of population.
,, Paris	3·77	,, ,, ,,
,, Dublin	3·94	,, ,, ,,
,, Manchester	3·92	,, ,, ,,
,, Cork	1·5	,, ,, ,,
,, Birmingham..............	0·467	,, ,, ,,

So that the visits, in proportion to the local population, at Paris, Dublin, and Manchester, considerably exceeded those in London.

If, however, we add together the visits to the Dublin, Cork, Birmingham, and Manchester Exhibitions, and the population of these towns, we shall find the aggregate visits were 2·98 to each of the population, while in London they were only 2·62; and if we compare the receipts in the same way, we shall find that £138,790 was realized, whereas in the same proportion to population as in London it would have been only £132,329.

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* Not to overload my letter with figures, I have quoted the results of the first, middle, and last Exhibitions.

But if we separate the numbers paying 1s. and under from the higher rates, the following result appears:—

In London, they were as	1·93 to 1 of population.		
Paris	3·56	,,	,,
Dublin	2·18	,,	,,
Cork	0·792	,,	,,
Birmingham	0·45	,,	,,
Manchester	2·71	,,	,,

By which we see the wide field that is open for greater receipts in 1861 than in 1851, if we admit the people more freely, and at lower rates than 1s. each. The lowest rate at Paris was 4 sous, which produced £17,459 out of £128,000; at Dublin, 6d., which produced £3,311 out of £29,000; at Cork, 6d., which produced £1,200 out of £2,874; at Birmingham, 6d., which produced £691 out of £3,632.

These figures clearly prove that Exhibitions of very inferior merit to that of 1851, and to what is proposed in 1861, excited great general and local interest in their respective districts, and secured vast numbers of visitors. Even at a small provincial city like Cork, where a large proportion of its inhabitants are poor, and entirely outside the class able to pay to see an Exhibition, we find the number of visitors in proportion to the population, next to those in London.

We may also add, with respect to the Exhibition of 1851, that so little was it understood, and so limited was the circle of attraction at first, that it was not until the press teemed with accounts of its wonders that the people flocked to see it. The next will open under more favourable circumstances. The public are more instructed upon the value of an International Exhibition, and will be ready, in 1861, to accept its teaching, and enjoy its beauties and curiosities, if even it should be in some respects inferior to 1851.

Let us now try it by another test,—that of the receipts. The first result to observe is, the small proportion of the receipts obtained from the high rates of admission, and how entirely the success has depended upon the smaller contributions of the masses.

Thus, in Paris, the 5 francs and 2 francs produced £14,400 out of £128,000, or ·109 of the whole amount.

In London, the 20s., 5s., and 2s. 6d. produced £134,836 out of £356,807, or ·378 of the whole amount.

In Dublin, the 5s. and 2s. 6d. produced £4,521 out of £28,980, or ·156 of the whole amount.

In Cork, the 2s. and 1s. 6d. produced £678 out of £2,827, or ·239 of the whole amount.

In Birmingham, the 5s. and 2s. 6d. produced £359 out of £3,632, or ·098 of the whole amount.

In Manchester, the 2s. 6d. produced £16,451 out of £60,506, or ·272 of the whole amount.

Or by reversing this table we find that, in Paris, the 1 franc and 4 sous admissions produced ·891 of the total receipts.

In London, the 1s. admissions produced ·622 of the total receipts.

In Dublin, the 1s. and 6d. admissions produced ·844 of the total receipts.

In Cork, the 1s. and 6d. admissions produced ·761 of the total receipts.

In Birmingham, the 1s. and 6d. admissions produced ·902 of the total receipts.

In Manchester, the 1s. and 6d. admissions produced ·73 of the total receipts.

This plainly shows the great interest the people take in these Exhibitions, and to whom we must look for their main support—an interest quite apart from fashion or other accidental circumstances which affect the classes represented by season tickets.

From these figures we infer that if attraction be supplied for amusement and instruction at proper rates, the people will be candidates for admission.

In the above tables we have excluded season tickets, believing that if the Royal Commissioners of 1851 direct the Exhibition of 1861, and it is known that it excites the interest and attention of her Majesty and Prince Albert, the number of season ticket holders will equal, if not surpass those of 1851, for the foolish fears of many, and the ignorant prejudice and opposition of others, cannot in 1861 affect, as they then did, the sale of season tickets.

Then, when considering these results and applying them to another Exhibition, the increase of population interested in Arts, Manufactures, and Commerce, and the extension of trade in London since 1851, must not be lost sight of.

It is said, however, the people are tired of Exhibitions. What is the evidence of this? Is it to be found in the crowds who resort to comparatively trivial sights, or in those who attend whenever the attraction appeals more directly to the taste or the minds of visitors, and is of an educational character.

For instance, can an inference be drawn of any relaxation of interest in Public Exhibitions from the numbers who attended the opening of the Sydenham Crystal Palace, only three years after 1851—when the gorgeous richness and novelty of the one could be compared by nearly every visitor with the comparative feebleness and palpable imitation of the other, and when the recollections of the beauty, variety, and value of the articles so recently before their eyes were fresh in the memories of all. Yet before the opening of the Crystal Palace there were 20,183 Season Tickets sold at £2 2s. each, and even in the third season there were present, on one occasion, 15,867 Season Ticket-holders, besides 4,932 who paid half-a-guinea each at the door.

Or shall we refer to the Season Ticket Holders at Dublin and Cork.

At Dublin the receipts from them were £18,238, representing 366,745 visits; and at Cork £1,545, representing 54,936 visits.

The average number of visits by Season Ticket Holders:—

In London was	32·2 to each Ticket.		
,, Dublin	34·9	,,	,,
,, Cork	37·2	,,	,,
,, Manchester	22·9	,,	,,

May we not then safely infer that if these results were realised so soon after 1851, larger proportionate results will be attained in 1861. If this inference be correct, then the receipts for Season Tickets may be safely relied upon to the full extent of 1851, say nearly £70,000.

Indeed, there is every reason to believe, that if the educational result of 1851 has produced such satisfactory results in the purely Local Exhibitions held since that time, the international character of the Exhibition of 1861 will place it so far above all these as to secure the greatest amount of success, and further we may expect, that as our rivalry with foreign manufactures in all parts of the world increases, so will the desire by Foreigners as well as Englishmen to see their mutual progress be increased, and thus secure to each decennial Exhibition a greater and greater amount of attraction.

To all these illustrations from the past success of Exhibitions we may add, as affecting the next Exhibition in London, the fact of the annually improving and increasing railway communication between the metropolis and the country, and between the distant parts of the metropolis itself; this will afford facilities for visiting the Exhibition to many who were excluded in 1851. But in addition to all these facts, we must not forget the large proportion of those who attended in Hyde Park that have since passed away and been replaced by others whose interest and curiosity will alike induce them to visit the next international Exhibition.

The extent to which the increased railway accommodation may contribute to the success of the Exhibition we have but meagre means to estimate, but if the increase of the traffic of 1851, during the period of the Exhibition was above 25 per cent., the same rate of increase in the traffic of 1861 will produce very much larger results, and as this increase of traffic in 1861 will arise very much from the larger area which will then be open to railway traffic, an equal result may be fairly expected. This is shown by the fact, that in 1851, the number of passengers by railway was 85,000,000, and that in 1857 it had increased to 140,000,000.

I am, Dear Mr. Dilke,
Yours faithfully,
WILLIAM HAWES.

C. Wentworth Dilke, Esq.,
Chairman of Council of the Society of Arts.

P.S.—I have had some difficulty in obtaining the figures relating to the Exhibitions. If not perfectly accurate, they are substantially so, and sufficiently so for all practical purposes.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement :—

For Belfast.

Rev. R. J. Bryce, LL.D.
Mr. Wm. Dunville.
Mr. Samuel G. Getty.
Rev. James McCosh, LL.D.
Mr. Joseph John Murphy.
Mr. Robert Patterson.
Mr. Hamilton Pink.
Rev. J. Scott Porter.
Mr. William Thompson.
Mr. George Orr Wilson.
Rev. Wm. Anderson, A.M., 23, Lonsdale-street, Belfast, *Secretary*.

For the Glasgow Athenæum.

The Very Reverend Thomas Barclay, D.D., Principal of the University of Glasgow.
Dr. W. G. Blackie, Publisher.
Mr. Ernest Dronké, LL.D., St. Vincent-street.
Rev. John Eadie, D.D., LL.D., Professor of Theology, U.P. Church.
Mr. James Gourlay, Banker.
Rev. William Hetherington, D.D., LL.D., Professor of Theology, Free Church College.
Mr. James McClelland, Accountant.
Mr. J. P. Nichol, Professor of Astronomy, Glasgow University.
Mr. Alexander Ritchie, Accountant.
Mr. John Strang, LL.D., City Chamberlain.
Mr. Michael Thomson, Insurance Agent.
Mr. Moses Provan, 110, West George-street, *Secretary*.

⁂ The Local Board, of which a list was published in the *Journal* for the 11th inst., is that for the Glasgow Mechanics' Institution.

For Lockwood.

Rev. John Barker, View-place, Lockwood.
Rev. J. B. Bensted, M.A., Lockwood Parsonage.
Mr. Bentley Shaw, J.P., Woodfield-house, Lockwood.
Mr. Alfred Lee, Mechanics' Institution, Lockwood, *Secretary*.

For Sheffield.

Rev. Canon Sale, D.D., Vicar of Sheffield, *Chairman*.
Mr. Edw. Birks, People's College.
Dr. Elam, Surrey-street.
Rev. James Moorhouse, B.A, Vicarage.
Rev. Edw. D. Ward, M.A., Head Master of the Collegiate School.
Mr. Thos. Rowbotham, People's College, *Secretary*.

ENGLISH ART IN FRANCE.

The following letter has been addressed to Mons. Theophile Silvestre :—

London, 15th February, 1859.

Sir,—We have received with great interest the kind invitation of H.E. the Minister of State and of the Household of the Emperor of the French, who has reserved a special room for our works at the Exhibition of the Fine Arts, which is to open on the 15th of April next in Paris. We are much gratified by this appeal of the French Government, and we hasten to answer it.

We would suggest that H.E. the Minister of State should instruct you to appoint in London a person who, in conjunction with us and with yourself, should be specially intrusted with the duty of receiving our works.

We have full confidence in the Director of the annual Exhibitions of French pictures in London, Mr. Ernest Gambart, and we should be glad to find H.E. the Minister of State showing his concurrence in our sentiments by appointing that gentleman to act with you.

We have the honour to be, Sir,
Your obedient Servants,

C. L. Eastlake, P.R.A.
W. Mulready, R.A.
C. R. Leslie, R.A.
E. Landseer, R.A.
David Roberts, R.A.
C. Stanfield, R.A.
Chas. Landseer, R.A.
Daniel Maclise, R.A.
W. P. Frith, R.A.
Samuel Cousins, R.A.
E. M. Ward, R.A.
W. Holman Hunt.
Thomas Creswick, R.A.
Fred. Tayler, P.W.C.S.
Thomas Landseer,
T. D. Harding,
Thomas Faed,
Charles G. Lewis,
John Phillip, A.R.A.
G. E. Hering.
Frank Stone, A.R.A.
W. H. Simmonds,
Fred. B. Pickersgill, R.A.
W. Hunt,
S. A. Hart, R.A.
Richard Ansdell,
Alfred Elmore, R.A.
Charles Oldham Barlow,
Augustus Egg, A.R.A.
Henry O'Neil,
Abraham Solomon, &c., &c.

TWELFTH ORDINARY MEETING.

Wednesday, Feb. 23, 1859.

The Twelfth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 23rd inst., Thomas Sopwith, Esq., F.R.S., Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Deacon, Henry
Errington, Rev. J. R.
Houghton, Frederick B.
Mackintosh, Robert James, M.A.
Neilson, William
Starr, Henry.

The Paper read was—

ON THE LIBRARY, BOOKS, AND BINDING, PARTICULARLY WITH REGARD TO THEIR RESTORATION AND PRESERVATION.

By John Leighton, F.S.A.

In any effort that tends to the careful preservation of the literary treasures contained in our museums and libraries, I am sure that I shall be cordially seconded by the Society of Arts: a society that—whilst it pushes forward, diving into the future—can well afford to pause and think kindly of the protection of those landmarks of the past yet remaining to us.

My observations will not now touch upon the value of individual rarities in either books or bindings, but rather be directed to the better order or good government of that sanctuary—the Library—the place in which is embalmed the holiest part of man's nature; the place to which the devotee of to-day may retire and commune with the master-minds of past ages—be it for consolation or amusement.

The library ought to be of good proportions—lofty, fire-proof, well aired, lighted, and warmed—being furnished with due regard to the protection and preservation of its contents. The room best suited for this purpose is one on the first-floor, or above a vaulted chamber, having but one external wall, with windows facing the north, imparting an even steady light, without the glare of sunshine or heat, which parches and fades the colours of bindings and other contents.

The library should be surrounded by shelves, and if lofty, also by a gallery, for convenience of access; though, on no account, should the cases approach the ceiling, where in most rooms the air is hot and vitiated; as this tends to destroy, or rather impoverish, leather and other materials. The best and oldest plan of decoration above shelves is by busts, portraits of worthies, or trophies, agreeable to the eye and mind.

Mottoes and quotations, either upon cornices or entablatures, are pleasing incentives to study:—as,

A · WISE · BOOK · IS · A · TRVE · FRIEND. ITS . AVTHOR ·
A · PVBLIC · BENEFACTOR.

BOOKS · TEACH · VS · TO · REFINE · OVR · PLEASVRES · WHEN ·
YOUNG · AND · TO · RECALL · THEM · WITH · SATISFACTION ·
WHEN · OLD.

A · LIBRARY · OF · TO-DAY · CONTAINS · THE · ESSENCE · OF ·
ALL · THAT · IS · WORTH · PRESERVING · OF · WHAT . HAS ·
BEEN.

BOOKS · ARE · THE · CHEAPEST · ENTERTAINMENT · AND · THE
MOST · LASTING · PLEASVRES.

A · MAN · IS · BUT · WHAT · HE · KNOWETH.

BOOKS · ARE · KIND · FRIENDS. WE · BENEFIT · BY · THEIR ·
ADVICE · AND · THEY · EXACT · NO · CONFESSIONS.

L'VNIVERS · EST · GOVVERNE · PAR · LES · LIVRES.
VN · BON · LIVRE · EST · VN · BON · AMI.

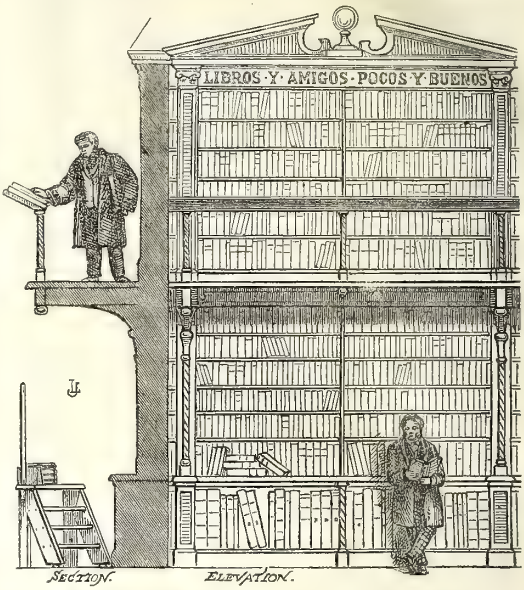
ANIMI · PABVLVM. ANIMI · MEDICINA.

VN · VOMO · LETTERATO · NE · VAL · DVE
CHI · PIV · SA · E · PADRON · DEGLI · ALTRI.

LA · VERDAD · ADALGAZA · PARO · NO · QVIEBRA.
CIENCIA · ES · PARA · POBRES · RIQVEZA, · PARA · RICOS .
PRIMOR, · Y · PARA · VIEJOS · CONTENTAMIENTO.

NO · HAY · MAS · CIETRO · Y · DELEITOSO · AMIGO · QUE · EL ·
BVEN · LIBRO.

The lower or floor shelves of the library, next the ground, should contain folios and other large works—and may project rather more than eighteen inches into the apartment, affording a ledge, about the height of an ordinary sideboard, on which to rest with comfort such quarto and octavo volumes as are in use—the space above which, under the gallery, being appropriated to quartos and works of every-day use, which it is well to have within reach of the hand,* or at least from the dwarf steps (contrivances that should be light, strong, and easily moved about, having the wheels or castors under the step portion alone, to prevent accident). The upper or gallery shelves would hold octavos and smaller works—of less frequent reference than the lower cases—the gallery being sufficiently wide to permit two persons to pass—having a light ledge or over-hanging desk on which to rest the volumes—the floor being covered with felt, or some such substance to deaden the sound in walking thereon.


LIBROS · Y · AMIGOS · POCOS · Y · BUENOS
SECTION.
ELEVATION.

In great public or private libraries most convenient and commodious cases may be erected, abutting into the apartment from the piers of windows, as they do not obstruct the light or air, and afford pleasant bays in which to study in quiet: at the Bodleian Library these compartments have gates, forming snug reading rooms, from which the public are excluded. The library should be furnished with tables, covered with leather or cloth, having convenient drawers, also chairs—easy, without being luxurious,—portable desks and reading cushions for heavy books, with metal mountings or bindings, that

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* Shelves can easily be constructed within reach of the hand, about seven feet from the floor; though in the British Museum and some other new libraries they are more than that. If the steps are to be used at all, then it is judicious to have the cases nine or ten feet high (as in the engraved elevation). If possible the shelves in every part of the library ought to be of one width, that the books, when necessary, may be transposed *en masse.*

should never be introduced into the shelves with other volumes, as they would—by their protuberances—be like to injure them: they may be put in the drawers of library tables, with thick glass tops, and thus be seen, whilst the tables afford space on which to place things in general. To complete the furniture, a few presses with sliding trays (somewhat as a wardrobe) for folios of prints, an ample screen or two, and a light waggon for transporting volumes, will be useful.

In constructing book-cases it is always well to think of the growth of a library, its ever increasing population that must have lodgement, the time when increased accommodation must be obtained. In book-cases it is perhaps not well to have them in divisions of more than four feet wide, or deeper than royal quarto, on the upper tier: as small compartments are more compact, fewer volumes being disturbed when in use. "The Delphin Classics" is perhaps as long a set books as we may have to legislate for, and these would only occupy about five shelves: the rack-work at the sides, for elevation and depression, ought to be sunk within the cheeks—so as not to encroach upon the book space to their injury in sliding in and out; nor should the cheeks be so made that a volume may become hidden behind the pilasters or heavy framing, as is sometimes the case, for then volumes get out of sight and out of mind. It is well to have shelves covered with leather, being rounded at the edge to prevent sharp scraping angles, and also strong enough to bear the weight imposed upon them. Strips of wood are sometimes inserted at the back of shelves, forming ledges to receive the volumes, making them range evenly. Blocks somewhat resembling thick volumes, are useful for insertion, to prevent the books falling on the sides, as they are apt to do when a few are subtracted.* The great difficulty of definitely stating the height of the shelves in all libraries, comes of the variety of sizes of printed books, from the ponderous folio of our forefathers to the pocket diamond classic that so persecuted the eyes of our fathers.

The covering of books in the library from dust, light, and intrusion, is somewhat difficult; for whilst that old-fashioned protector, chequered wire, kept out idle hands, it afforded no defence against bleaching, dirt, or vermin; and, moreover, was unsightly, rendering the titles on the backs not easily read. The most economical method of partially defending books from dust, is by the affixing of small leather falls (some say cloth is the best) to come down over the heads of the books as they stand upon the shelves, and when the works fit their compartments this does pretty well, though a still better way is to have tammy or silken blinds, hung upon spring rollers, to draw down over the books during such periods as the library is not in use, or whilst cleaning.

The best covering for choice bindings is decidedly glass, as they may be perfectly seen and protected from all but the bleaching effect of light; smoke and soot, in the great metropolis, are more offensive, if not more destructive, than dirt in the country—where books suffer from parching and bleaching. To still further fortify against the insidious enemy, it is well to cover the tops of the volumes with stiff glazed card or millboard, from which the particles of dust can be removed, from time to time, with a cloth; the only thing against this plan is the various sizes of books; thus it will only serve for volumes of uniform size. Dirt is particularly apt to intrude between the sections of books that have not been cut with the folder, and is even perceptible after binding, here and there discolouring the top margin: gilt heads are decidedly the best protection from dust, as it can easily be removed from the precious metal by the application of a soft brush. The state of many a large collection of books is disgraceful from the apathy both of owner and librarian, who estimate little the importance of their trust (for the ownership of works of literature and art is but a trust, books and pictures being for all time), deputing the removal of literary treasures to upholsterers' agents, and their purification to the ruthless brush of the housemaid, who, if she does not beat the books together, like a pair of old slippers, will swing them by the boards, doubtless driving a portion of the enemy inwards. To prevent dust falling into volumes, I have heard of a proposition to place all books upside down upon the shelves, thus all dirt would fall away on the perusal of the work; of course this plan, if carried out, would necessitate the reversings of the letterings on the backs of the books. A gentle hand in using a book will do it good, whilst a rough one is sure to do it harm. The library requires similar attention to the greenhouse —light, air, and equal moisture, ought to be imparted to the leaves in either case—light without injury to colour, moisture without mildew, and air without soot. These things are as necessary to the librarian's, as to the gardener's charge. Whilst upon the subject of dust, I would advise that the library carpet be swept there as little as possible. The best covering for a library floor is a rich, but not bright, Turkey, that should in no case reach to the wall, but leave a margin round the room, on which the furniture may be placed whilst the carpet is removed entirely to be purified, a thing one would like to do with the chimney: great care should be taken in sweeping, and that smoke never be allowed to escape into the apartment.

The next important enemy to literature is damp—that great decomposer and discomposer of all things. Now, though a certain amount of humidity is necessary (as much as may be contained in a pleasant atmosphere), absolute damp is destruction. Rot! Damp, even from soft stone and ivy-covered walls, is very injurious—especially where book-cases are placed against such external walls —and more particularly in closed cases, as the damp then has no such opportunities of escape. A library should never be constructed upon the ground-floor for that reason; and it is better, as I before mentioned, to have your library enclosed upon three sides by offices or apartments; that is to say, upon such sides as the cases are placed, for paper is most susceptible of damp, particularly, as I am informed, when made with putrid size,* and emits a mouldy smell long before decay or mildew is perceptible; when it is, the best method to avert ruin is to have every volume opened (where affected), leaf by leaf, in a warm dry room, page after page being wiped with a clean cloth. I have known books much damaged thus spared, whilst others, though not obliterated, have become a mass of discoloured print and paper, so tender as to crumble by the touch. To render such paper again strong, resizing must be resorted to; if too tender for that, let every leaf be firmly pasted between two sheets of transparent paper, through which the print will appear, somewhat fainter perhaps, but still clearly enough; the only thing to be feared in this process is the paste becoming impoverished, in which case the leaves would be again set at liberty. A first folio edition of Shakspeare has been so treated in the British Museum. Some magnificent books of plates become spotted, as if by iron-mould, with but little damp, which seems attracted by the poor flimsy tissue paper in use some years ago, and issued with such works as "The Stafford Gallery," the "Musée Napoléon," &c. The wardens of cathedrals and colleges should carefully guard against damp, particularly if their buildings, appropriated as libraries, be adaptations of chapter-houses and cloisters. Good ventilation in some places is necessary on both sides of the cases. In the British Museum, though dry, all the glazed doors are left open one day in every week.

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* There is always a difficulty in bookshelves, namely, that the books fit them either too tightly or too loosely; if tightly the friction is great, if loosely the volumes are apt to become soft—dust and bookworms finding freer entrance. What is wanted here is some sort of wedge to press them up compactly together.

* In the manufacture of modern papers, many chemical preparations are now used to impart texture and colour, injurious to the fabric: thus, books are printed on whiter paper than of old, and also upon paper artificially toned as if by age.

Now, though damp is so injurious to paper, leather appears to resist it better than extreme dryness, a great enemy to bindings. Heat, and particularly heat from gas, so affects leather that it becomes impoverished. as was the case in the library of the Athenæum Club, where, some years since, the calf and Russia bindings suffered severely,—so severely that they crumbled under the touch, the backs falling away, the boards alone hanging by the slips or strings on which the book is sewn and by which it is held to the boards, all the oily matter seeming as if dried out of the leather—a fault common in Russia and some modern calf-skins, and perhaps capable of being averted by the introduction of glycerine or some such matter; at least, it would be worth experiment where leather is hard, rotten, or likely to fail; some composition to render it soft and pliable, without stain or injury, would be a desideratum. The varnishing or furbishing of old leather, alone, can add little to the strength of bindings, though it may somewhat tend to repel the action of the atmosphere, it will also tend to the hardening of the joints or parts where the greatest action takes place upon the opening of a book.

At the Athenæum Club Library, Mr. Faraday introduced a gas-burner, with a chimney for conveying the deleterious fumes therefrom to the outer air; a plan that I believe tended much to arrest decay. The best mode of illuminating a private library is by oil; for not only does it afford a rich mellow light, but it is also less likely than gas to tarnish gold or destroy brass work therein. Libraries in some cases are lighted from external parts, as the roof, and from without the windows; then the objections to gas vapours cease.

Having disposed of the effects of damp and heat—the two elements that are always at work, reducing the arts of man to their primitive state—there yet remains another—the book-worm :[*] I do not allude to the book-loving biped, but the book-devourer, that respects neither books, bindings, nor the shelves on which they are placed, eating its way through all—indeed, I have seen books so pierced, that they resembled a piece of lace or a child's puzzle-map. The book-worm is an insect not often seen even by those passing a life amidst volumes and well-acquainted with its ravages.[*] The damage done by this little animal is effected whilst in the larva state, after which, on arriving at perfection, it flies away, being the same species as that which bores into wood, and I have often noticed it in beech, particularly in the old presses and furniture of book-binders' workshops; thus, in the construction of library fittings, it would be well to avoid all woods grateful to the pest: I am informed that good solid oak is as little likely to be affected as any timber that can be adopted. In bookbindings there is but little doubt that old wooden and pasteboard covers are worm preserves, and as such, dangerous protectors, whilst modern millboards, made of well-tarred rope, from the nature of the materials will be more likely to resist attacks if not entirely to avert them. Russia leather was at one time considered an orthodox preventive, yet I have seen it pierced by insects, a thing rarer in vellum books and bindings. Dr. Dibdin has, I think, rather unfairly proscribed hogskin, as "grateful to the worm," though I have not found it to be more so than other coverings. The insect pierces the exterior to get at its food, and when in the boards or backs, is less likely to be disturbed; thus are those parts more freely attacked. In searching for worms it would be well to fill the holes in backs and boards with some composition destructive to animal life, in the form of a stiff paste, which could easily be done without injury to the books.

Of preventives, *corrosive sublimate*, and *colocynth* or bitter apple have often been mixed with paste by the binders, who have also washed leather and linings with solutions of them; but how successfully I know not, never having heard of anyone who noted results. Starch, alum, and *vitriol* (a remedy worse than the disease), have also been proposed, and *salts of ammonia* in the glair (or white of egg) for gilding.

Mites sometimes are engendered in the flour of which paste is composed, and I have known all the adhesive quality destroyed by these insects without touching the paper; to prevent this, alum—the ordinary substance introduced into paste by the binders—I think is good, as it is destructive of that saccharine matter apparently so grateful to these insects.

In tropical climates British bindings suffer much, all paste and glue seeming to lose its virtue there, while insects, much more numerous than here, dispose of the paper quickly. In China, I am informed, that there are few books older than the invention of printing in Europe, they having fallen a prey to the cockroaches; indeed, upon opening cases of Chinese books, at the British Museum, great is the slaughter of these and other insects, that if they escape, come but to die in our temperate climate. In China books rarely appear to be "*bound*," unless stitching can be so called, several *brochures* being contained in a lap-over case, open at the ends, on the paper of which the title is inscribed in native characters.

In India books and manuscripts suffer in the like manner, unless the leaves are impregnated with a preparation of *Orpiment*, which imparts a yellow colour to the paper; if chalk be added, then the tone is changed to blue.

In some Mahometan countries there are MSS. as old as the tenth century, but I think not upon paper.

In England, where books are used and light and air freely admitted, vermin [†] will not, I think, prevail; and it is the office of a good librarian to see that they should not: perhaps the periodical fumigation of a library with tobacco, or other substance, would be well.

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[*] The larva of *Aglossa pinguinalis* will establish itself upon the binding of a book, and spinning a robe, which it covers with its own excrement, will do it no little injury: as also does a minute beetle of the family of *Scolytidae (Hypothenemus eruditus)*. which Mr. Westwood found burrowing in considerable numbers in the same situation. I have also often observed the caterpillar of another little moth, of which I have not ascertained the species, that takes its station in damp old books between the leaves, and there commits great ravages. The little wood-boring beetles *(Anobium pertinax* and *striatum)* also attack books, and will even bore through several volumes. M. Peignot mentions an instance where in a public library but little frequented, twenty-seven folio volumes were perforated in a straight line by the same insect (probably one of these species) in such a manner that, on passing a string through the perfectly round hole made by it, these twenty-seven volumes could be raised at once. The animals last mentioned also destroy prints and drawings, whether framed or preserved in a portefeuille, and even paintings: it appearing from a Parliamentary report on the state of the paintings in the National Gallery, and subsequent observations of M. Waagen, that the paste applied to the canvas of the fine picture of the Raising of Lazarus, by Sebastian del Piombo, has been so attacked by the larvæ of an insect (supposed to be *Anobium paniceum*) that its destruction is to be feared if some remedy cannot be found. The same insect has done considerable injury, as we learn from Mr. Holme, to the Arabic manuscripts in Cambridge Library, brought from Cairo by Burckhardt.—Kirby and Spence, "Introd. to Entomology" (small edit: p. 138). London: 1858. The book worm belongs to the family of the *Ptinidae*, corresponding with the Linnæan genus *Ptinus*, in the order of the *Coleoptera*.

[*] At the Bodleian Library, in hunting for book-worms the assistant was rewarded by the discovery of about one a day. These he found mostly in books of two centuries old—frequently in old foreign works.

[†] Damage done by rats and mice to books upon shelves is not frequent, as they do not eat paper, though they may gnaw through it in constructing passages and nests. I have known a mother and young mice *sold* in the Reports of Parliament as waste paper.

Having treated of the pathology of books, and prescribed the best known remedies, we will now touch upon costume, and other matters. In rebinding an old volume, it is well to make the new one a restoration, as not only do you thereby obtain a good style, but one that best suits its complexion; to put an old book in a fine new cover evinces want of taste; indeed, volumes should never be rebound unless in a dilapidated state and past repair. Then should the stained leaves be carefully soaked in hot water to remove foul marks, great caution being exercised in taking out ink-stains by the use of lime and acids that ruin paper though they make it appear fair; if the sheet be tender or over absorbent, afterwards dip in pure vellum size, which will, when dry, impart strength. If any of the leaves are torn, let them be carefully mended with paste, and if valuable, the printed portion be restored, as can be done from a more perfect copy; if not of much importance, the blank space may be left as evidence of the missing part, or even be written upon in fair script, with a common pen. Small plates and leaves can be inlaid into larger ones; thus may a duodecimo be made into a folio, with a grand margin for illustration and annotation. Whole plates and pages may be done in fac-simile by photography, or reproduced by the anastatic process, especially where the original is not too dry, dirty, or too valuable to be risked in the process; for sometimes the damp and pressure it is subjected to, is apt to injure the thing to be duplicated without realising a fair copy. Prints of two centuries old have been reproduced successfully by this means, though it is not always certain: for the literal reproduction of a magazine or newspaper article nothing can be better. Lithography is also excellent as a reproducing agent, by tracings from valuable originals, and especially so for autographs and letters.

Having touched upon most of the methods of restoring and repairing single leaves, I must not omit another process that has come to the aid of the bookbinder—the splitting of sheets of paper. To show how valuable this is at times, I will tell you how a rare old book was made complete, that otherwise could never have been made so, the fact being that the printer had turned his sheet the wrong way in perfecting the impression from his types—thus every page was backed by text due some pages in advance or arrear, and it was not until every leaf of that sheet was split, and each page united to its proper fellow, that the book could be called complete. Little did the printer of old, when he plied his press in Spain, centuries ago, think that his error would thus have been corrected here. The rare old book was on Painting, by Pacheco, the master and father-in-law of Velasquez, and is now in the possession of Mr. Stirling, of Keir; having been patched and completed from a duplicate copy in possession of the Earl Ellesmere.

Notes and annotations upon fly-leaves and margins, unless trivial, I think it good taste to preserve with care (pencil notes being fixed with milk or clear vellum size). I would also retain the book-plates* or arms of the former owners, which, in rebinding, can easily be removed and placed on the end board, to be handed down with the badge of its present possessor—hereafter to become matters of history. As to the boards of very old books—never destroy them until proved worthless, for sometimes they are made up of curious old deeds and documents, illuminations, old copper-engravings, and woodcuts—perhaps useless in their time, but certainly curious now.

It is well to direct the bookbinder to keep volumes entrusted to his care as much in their integrity as possible—never to tear away fly-leaves and half-titles, as is often done, for they are part of the book (and in some cases alone carry the imprint of the printer).

"Preserve and protect" ought to be conspicuously written in all libraries. How valuable would be some of our serials with all their advertisements*—*The Gentleman's Magazine*, for instance:—are there not there to be found notices that tell the history of publishing for above a century—the prospectuses of the early insurance offices for fire and life, the rise and fall of the lotteries, a reflection of Jacobitism, of Republicanism, and many other isms passed away? I do not say bind up with the *Quarterly*, or *Edinburgh*, such bundles of modern paper as are issued with them; though, should any complete set escape the binder's knife but for a century, they will, from their rarity, be more valuable than the work itself. In binding a work published in parts, it is well to order that one of the number covers be bound in at the end to show the method of publication, as not only does it often contain some device not to be found in the book, but also an author's proclamation or protestation not always fulfilled: for instance, suppose Lord Macaulay's New Zealander, on the ruins of the British Museum, examining a fragment of one of Mr. Dickens' green serial covers, so prophetic of the tale—would not that at once explain a style and method of novel writing either originated or lost in the nineteenth century.

In the bookbinder's hands maps and plates require great care, so as to be fairly, squarely, and properly placed in their respective positions—all inscriptions upon plates being made to read *up* the page. Books of plates should never be heavily pressed, as it is apt to injure the texture of the impressions; a print from an incised plate being ink in relief on the paper, and as such ought to stand upon it rather than be pressed therein. *Tissue paper*, as it is called, should be placed between impressions from engraved plates and letter-press, to prevent transfer—unless old, and even then it is pleasant to see the plate protected by thin highly glazed paper, to the full size of the page, yet thick enough to stand therein without creasing or protruding from the front of the volume. The old flimsy tissue paper, as I said before, was not only deleterious from its attracting damp, and thereby contracting stains, but is full of knots, and apt to fall into the back of the book, rather tending to injure than preserve; this should at once be removed.

As to maps, I would advise their being separate from the volumes, as they much interfere with the solidity of a book, when bound up with it, and are apt to tear away; to those who do not know how to use a volume, a map affixed thereto is an insuperable difficulty—to be folded and refolded in every direction until it becomes rumpled and destroyed. Large maps ought to be separately mounted on linen, and made to fit into pockets at the end of the volume; two or three fold maps may easily be retained therein, being mounted on a guard the full size of the page, and thus exposed beyond the volume for reference during reading.

In binding modern works great care should be taken to avoid "*set-off*" (or the transfer of ink from one page to another), a circumstance much more likely to occur now that books are pressed by the rolling-machine than when they were rendered solid by being beaten with the hammer on a stone. Books, also, or rather printed sheets, when fresh from the press, are apt to be much damaged by the action of the folding-knife—by having that instrument sharply drawn across the sheet, producing a glazed, bleared, diagonal line; this, with the indiscriminate side piercing of sheets (as in serials and pamphlets), injures the appearance of a book for ever, especially if a plate has to be turned in binding.

The binding of several books in one is much to be deprecated, unless in the case of riders, supplements or addendas, or when two or more volumes form an annual.

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* Book-plates, in old volumes, I am sorry to say, are not always to be trusted as evidences of ownership: booksellers sometimes soaking them off old boards to insert into other volumes and thus deceive collectors. Book-plates and labels ought to be of different sizes, the one for folio not suiting a duodecimo.

* In the British Museum, serials are bound entire, with their covers and advertisements, forming motley but interesting volumes.

The whole works of "*Voltaire*" have been crushed into one corpulent volume—a great feat, only to be admired for its difficulty—some amateurs, having fancies peculiar to themselves—loving thick books—as others, detesting margins, order their binders to cut books down to the print, and treat *margins* as mere waste paper. I have heard of a gentleman who, when he wanted a pipe-light, deliberately took down a volume from the shelves and robbed it of margin; and of another who, when he had read a book, threw it aside as useless; but happily these are rare exceptions, most proper minds respecting their instructors. To wantonly disfigure a good book with inappropriate stamps, is not only to mar the beautiful, but also to rob an after generation of a fair estate.

As to clothing, I think that I may say for book jackets "*there is nothing like leather*," though both vellum and calico are useful agents, and especially the latter, which, by the co-operation of London bookbinders and publishers, has reached a great pitch of excellence, particularly that known as "*cloth boarding;*" but of this department I shall say but little, design alone forming subject matter for a long paper. Leather seems the material *par excellence* for covering a book, as in no other material can so perfect a joint, or hinge, be made.

In flexible binding (where every sheet is firmly fixed to the cover), leather cannot be dispensed with; vellum and cloth only admitting of hollow backs, that is to say, where either material is to be decorated or appear neat. In the middle ages, I know that tight backs have been done, but always in combination with the heaviest workmanship and absence of finish; the lettering on the back being executed with a pen, whilst the wooden boards were left uncovered, and the fore-edge fastened by thongs.

In these books the sewing is very good, an important item in the strength of a volume, every sheet being sewn upon the cords or bands across the back. In the present day the bands are mostly hollow shams, having more to do with ornament than strength; the cords upon which the sheets are sewn being inserted into grooves made in the back by a saw—a neat way, but not so durable as the old method, particularly for heavy volumes.

Many books of the mediæval period are bound in vellum, and leather, without mill-boards. Formerly a pasteboard was used, made of the rudest materials—paper, cloth, old vellum, or what not; the earliest leather covers were principally of a rich brown calf, undyed, and so they remained until the early part of the present century; all the stains then in vogue being imparted to the skin by the bookbinder, who, by the judicious application of them, produced very beautiful natural effects—tree marbles, sponge dabs, sprinkled and spotted patterns, innumerable, though not always without injury to the leather, the surface of which the stronger acids were apt to burn after some years' action. The plain dyes given to calf in the whole skins, have tended to supersede the colouring of leather on the volume itself. The old, simple, *undyed calf* was exceeding good and strong, being more durable than many of the fancy-hued hides of the present day that seem to have the elements of decay therein before being put on the volume, and even afterwards are washed by the binder with oxalic acid, imparting a delicacy of surface most injurious to the skin. This is clearly evidenced in the binding of law books, uncoloured calf being always used (which, in combination with the white edges is, I believe, intended as typical of the purity of the profession), the leather being washed up with spirit to a fictitious whiteness, rendering it in a few years rotten, as many law libraries will sadly testify. Morocco, the earliest coloured old leather, is decidedly the strongest, richest, and best for the binders' art; it is a surface-dyed goat-skin, and no doubt first came to England on Venetian books, when that Republic was in its glory. It is the prince of leathers, having received the greatest and choicest amount of decoration, the most delicate and boldest of hand-tooling.

Hog-skin is a nice and durable material for bookbinding, though not much used; it takes blind-tooling admirably. Russia, unless used extremely thick, is a poor and rotten leather, if pared thin being little stronger than paper, and only to be prized on account of its odour and pleasant tone of colour. In bookbindings of the present day, leathers are pared and shaved much too thin, especially where strength is most required—at the joints, near the head-bands, a thing by no means necessary, if the leather be turned in the entire thickness, space being cut for its reception in the board—a plan I always have adopted for heavy books. Vellum is extremely strong and useful to the binder, though from its rigid nature hardly adapted to book-joints—at least as books are bound, or "*forwarded*," as it is termed, at present—unless it be those of account-books, where all strong materials, from hard writing-paper to horny bands of horny leather, are most prized. Vellum bookbinding for Banks, &c., is a distinct branch of trade, apart from bookbinding proper—that of printed books, on which it is somewhat difficult to get a whole vellum cover to set well, it being a material better suited to immovable parts, as edges, corners, linings, and inlayings.

Of fabrics, silk and velvet have been much used, though neither of them are susceptible of the highest branch of bookbinding, decoration by "*finishing*" as the gold-work is termed. Velvet, nevertheless, is extremely rich as a ground for gold or silver mountings, ivory, or carved wood; whilst, of all the fabrics that have ever been used in bookbinding, "cloth" has created the greatest revolution, and calico been made to appear every material save what it is—Morocco, Russia, moire antique, silk, marble-paper, &c.; but, for all that, it is a most valuable and durable material—a good substitute for paper, and the modern publisher's best friend. Thus many books in exquisite taste, more particularly on account of their impressed designs, take a prominent place upon the drawing-room table and the library shelves, to remain many years in their birthday suits, which a quarter of a century ago would have been worn out in as many months.

Colour, in bookbindings, is of great use if judiciously carried out, as an indication of subject: as dark brown, or purple for "divinity;" dull red, for "archæology" and "history;" green, for "botany;" red and blue, for "naval" and "military" subjects, with the usual piecrust colour for the "law."

As to the "finishing," or quantity of gilding, that must be regulated by the taste and purse of the proprietor—have he his books in whole or half-binding; though in any and every case it is well to have the date and place of publication at the foot of the volume, on the back, as it will save much trouble, and the book wear and tear in and out of the shelves. In the British Museum some foreign books have the title and a translation put on the back also; whilst at the Bodleian, above the lettering they indicate its class, as "Novel," "Biography," "History," &c., as the case may be, appending the author's name if known.

Regarding the colouring of the edges of volumes, red is perhaps the oldest pigment used, prior to gold and marbling (practices that are sometimes united on the same book), as also is picture painting or illumination, though simplicity is preferable, and gilt edges the best and most durable. For ease of research, Cyclopædias and Lexicons may be coloured in different hues upon the edges of the leaves, and lettered thereon, as we have applied to the "Post Office London Directory." *

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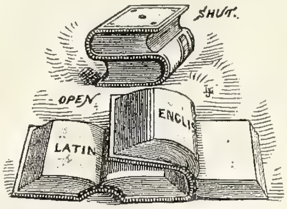
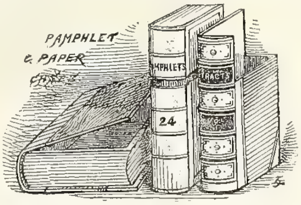
* This useful contrivance, as applied to *The Post Office London Directory*, was the joint production of myself and Messrs. J. and J. Leighton, the extra binders, of Brewer-street and is now so well carried out by Messrs. Leighton, Son, and Hodge, the large publishers' binders, of Shoe-lane.

Dictionaries in two languages may be bound on the plan of "twin-binding"—the uniting of the two parts, back to foredge, in such a manner as to expose the page of English-Latin and Latin-English at the same moment.



In bookbinding there is no greater difficulty than a judicious disposition of pamphlets. In the best collections I know, these dirty specimens of vagrant literature are bound somewhat in chronological order, in clumsy, spongy volumes, with a babel of titles on the back—titles often in themselves curt and contracted scarcely implying the real purport of the performance. As no collection of pamphlets can ever aspire to be quite complete, and the acquisition of an unknown tract may overturn all order, I would never bind together, but reduce to system thus—a plan little more expensive than collective binding—having each work done separately in what is called "*limp*," in a stiff cloth cardboard cover, somewhat as a memorandum-book, with a paper label on the side to receive the title in MSS.: the colour of each little *brochure* indicating its subject. These, divided and subdivided, may be either kept between boards (bound together by India-rubber bands), or be contained in Solander cases* or boxes made somewhat to resemble a book. In the British Museum pamphlets are bound separately, in single volumes, in a slight cover.



In alluding to order and arrangement come ideas of catalogues, and that much-mooted subject, how to make one?—a question of great difficulty to solve, and so dependent on circumstances—be the library large or small, universal or special, private or public. On this question I should be loath to dictate, as most plans have some advantages; it is an open question, and one alone to be discussed upon a careful perusal of all the old and new forms extant. Without a catalogue no collection ought to be; it is the inventory and source of all order, every volume being marked in accordance therewith—not in vulgar scribble or by patchy labels, as is too often the case, but with neatness and precision.

Before taking leave of the library, a few remarks on sham doors may not be out of place,—those false contrivances that so delighted our forefathers, and without which at one time no library was thought complete, making the place a sort of man-trap in which to catch the unwary. Like all shams, dummy-doors are to be deprecated—unless, perhaps, it be in out of the way corners, as coverings for closets; and then the titles of the works selected ought at once to indicate the fictitious nature of the spot. In the collections of the Duke of Devonshire at Chatsworth, and the late Samuel Rogers, in London, these false backs were made the medium of much wit: instead of mock Miltons and spurious Shakspeares, tall Thompsons and short Spencers, fat Bacons and thin Longfellows, were to be found such books as "The Circle Squared," "Nebuchadnezzar on Grasses," "The Babylon Court Guide," "Sir C. Hatton on Dancing," "Canute on Tidal Waves," "Photographs of the Antients," &c.; these, with the titles of unwritten works of great authors, affording matter for thought.

With a few desultory remarks upon the handling of books I will conclude, being well assured, that if properly used, volumes are capable of enduring for many centuries; and that if torn rather than lifted from the shelves, wrenched open instead of being gently coaxed, made to hold botanical specimens, paper-knives, letters, and other property, they will always suffer. There are few things more injurious to a book than baking it over a fire, or leaving it open face downwards, on pretext of "keeping the place," or damping the thumb in perusal; if fairly handled and gently turned, by passing the fore-finger of the right-hand under every leaf, from the top of the page to the bottom, it will smile fairly upon many generations, giving the best of advice without exacting any confession.

DISCUSSION.

The following letter has been received by the Secretary from Dr. LETHEBY, who says:—

I am sorry that my engagements will not allow me to be present at the reading of Mr. Leighton's very interesting paper, on the Restoration and Preservation of Books, and their Bindings; but I gladly accede to your request, and send you some specimens of the injury done to leather coverings of books by the products of the combustion of coal gas.

It is not sufficiently well known by the public that gas contains a large amount of sulphur, in a form that is not readily discovered. This, by combustion, is converted into sulphurous acid, which by absorption of atmospheric oxygen, quickly becomes oil of vitriol, and it is hardly necessary to say, that wheresoever this corrosive acid fixes itself upon any textile fabric, it slowly, but surely, exerts its destructive power. The leather binding of books is, from its very porous nature, peculiarly apt to absorb the acid, and hence it is more seriously injured by it than other tissues.

The proportions of sulphur in coal gas are very variable, but the results of a large number of experiments seem to show that the average amount is about 20 grains in every 100 cubic feet of gas. This will produce about 50 grains of anhydrous sulphuric acid, or rather more than 61 grains of the strongest oil of vitriol of English commerce. In some instances the proportions are more than twice as great as these; but supposing that amount to be not above the average, it will be seen that a large quantity of corrosive vapour is produced by the combustion of gas; and if a library is lighted with only four burners, each consuming 5 cubic feet of gas per hour, there will be produced in the course of five hours, which is not a long evening, as much as 61 grains of vitriolic acid; a part of this may be got rid of by ventilation, but enough of it will still remain to produce the most serious mischief to the bindings of the books.

That this is not a chemical speculation, but a matter of fact, is shown by the specimens before you, and by the following accounts which I have extracted from my report on this subject to the Corporation of London.

"Through the kindness of the managers of the Athenæum Club House, I have had access to the various documents which they possess, on the subject of the injury done to the library of that Institution by the products of burnt gas; and I find that in the summer of 1842 a Committee was appointed to investigate this subject, and that the services of Professors Faraday and Brande, Mr. Aikin, Mr. Brown, and Dr. Prout, were enlisted. Without going into the detail of their investigation, which went to show that oil of vitriol was the great cause of the mischief, I will inform you of the result at which they arrived. Dr. Prout said that he had taken two equal portions of the water used in the house, and had exposed one of these for a fortnight to the air of the drawing-room of the establishment; by which means he found that it thereby acquired a striking increase of sulphuric acid, so that when it was evaporated nearly to dryness it distinctly reddened litmus paper, and showed the presence of free sulphuric acid. 'This,' said Dr. Prout, 'sufficiently explains the destruction of the books, nor will there be any improvement till the gas is either removed or its fumes conducted away by appropriate chimneys.' Mr. Faraday and Mr. Aikin agreed in this opinion; and the Committee resolved that, as from the above experiment it appeared that much of the injury suffered by the books in the library is owing to acid vapours evolved by the combustion of the gas, it is advisable that, for the preservation of the library, the gas should either be discontinued, or that some arrangement be adopted for carrying off the fumes by an improved system of ventilation. In the end the latter was adopted at the suggestion of Professor Faraday, and, although the mischief has been to a great extent abated, yet, I am informed by Sir Henry Ellis, that he thinks he sees a certain degree of injury still progressing. Through the kindness of Mr. Magrath, the Secretary of the Club, and Mr. Spencer Hall, the Librarian, I am enabled to show you numerous specimens of the covers of books which have been thus injured; and you will notice that wherever they have been exposed to the atmosphere containing the vapours of burnt gas, they are as rotten as tinder; indeed, it often happens that the covers give way in attempting to remove the book from its place on the shelf.

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* So called after Dr. Solander, the botanist.

"At the London Institution, in Moorfields, the books have suffered in a similar way; and Mr. Brayley, the librarian, tells me that the books situated in the upper part of the room suffer most. He noticed that the surface of the leather of the binding lost its smoothness, and eventually the whole was reduced to a brittle substance, composed of a scarcely coherent powder, which had a powerful acid taste; to this he adds, that evidence has been obtained from bookbinders, as well as booksellers, of the deleterious action of gas lights and gas stoves on the bindings of books. In consequence of this a ventilating apparatus has been put up in the library of the Institution.

"Mr. Spencer Hall informs me that almost the entire library of the Earl of Tyrconnel, at Kilpin, in Yorkshire, whose mansion is lighted with gas, has been destroyed in a similar way; and Mr. Brayley confirms this fact. The latter gentleman has also told me that mischief of a like description has occurred in the Portico Library at Manchester; and, from a statement made in a leading article of the *Times*, of the 14th of January, 1854, it appears that the books in one of the rooms of the *Times* Office, where gas is constantly burnt, shrivel up and break after two or three years exposure.

"Some time ago when I visited the library of the Royal College of Surgeons, in Lincoln's-inn-fields, I was surprised to see how much mischief had been done to the bindings of the books by the products of gas combustion. I should think that in the gallery of that Institution there are hundreds, if not thousands of books, the backs of which are completely rotten; and Mr. Stone, the late librarian, tells me that he has the most satisfactory proof of its being due to the action of gas, in the circumstance, that whenever a book has been taken out of the library for any length of time it is found to be preserved, although its fellow volumes are thoroughly rotted. I place before you a few examples of the injury done to the books of that establishment.

"Mr. Thornhill, the librarian of the Literary and Philosophical Society of Newcastle-upon-Tyne, has written to me to say that an enormous amount of mischief has been done to the books of that Institution. 'It may,' he says, 'be stated generally, that all the books which have been in the library for a few years have suffered more or less from exposure to the action of the matters thrown off from the gas, and that large sums have been expended in bookbinders bills, and will yet have to be expended before the mischief is repaired.' The nature of the mischief, he says, is in the entire destruction of the texture of the leather, and even of the ends of the books; and, as might be expected, the books in the upper part of the room have suffered most. 'In a room where books of reference, such an encyclopædias, dictionaries, &c., are kept, and which is used also as a reading room, the quantity of gas burnt is large in proportion to the size of the room. In most cases the leather on the backs of the books in this room has been frequently renewed, both in cases in which the books were frequently used, and in which they were not used at all; the backs, in fact, became loose as the books stood upon the shelves.'

"And now comes a very instructive observation which has been communicated to me by Mr. Thornhill. In the case of books missing from the library being recovered, the leather of the books so restored has been found perfectly good, whilst the leather on the books in the same binding has been utterly destroyed, although the books had been standing almost undisturbed (except for being dusted) on the shelves; one book was recovered after having been out of the library ever since the year 1818, it had in fact been replaced; it is bound in an inferior Russia which is perfectly sound and good. In a set of Dodsley's Annual Register, bound in the same leather, and purchased a few years ago in first rate condition, the leather could be easily brushed off by a hard brush.

"It might be thought that the mischief here alluded to arises from other causes than the combustion of gas, but the proofs of its action are so clear that it is not necessary to discuss this point; indeed, I have ascertained by actual analysis that the leather on the sides of the damaged books is uninjured, while that on the back is completely rotten: this is dependent on the circumstance that the atmosphere is excluded from the sides by reason of their pressure against the neighbouring books, whilst the back is freely exposed to its influence."

I think, therefore, that Mr. Leighton has very properly recommended that "the best mode of illuminating a private library is by oil;" and where the use of gas cannot be dispensed with, as may be the case in our public libraries, the products of combustion should always be carried away in the most complete manner from the atmosphere of the room.

Mr. **Spencer Hall**, F.S.A., having expressed the gratification which the reading of the paper had afforded him, and the deep interest which he was sure must be felt by all present, in the preservation of public libraries, said he would follow up the remarks of Dr. Letheby, by placing before the meeting some of the results of the destruction that had occurred amongst the books of the library of the Athenæum Club. Whilst the inquiry was proceeding with respect to the destruction that was going on in the library, he was very much indebted to several practical bookbinders for the assistance they rendered him in helping to solve the difficulty, and for many valuable suggestions which they gave him. Amongst other things, it was stated, that the red dyed Russia leather was not to be depended upon for durability, in consequence of the materials used in its preparation, and it was suggested that if the pale Russia leather were used, the evil would probably be avoided. Mr. Spencer Hall then drew attention to three sets of volume of equal size, which had been all bound in Russia leather at the same time, and which had been deposited in different parts of the library. The binding of the volumes which had been kept under a glass case had alone been preserved, whilst the others had either become parched up and perished, or else had fallen into a condition of decay, the leather being reduced to dust, which emitted a most disagreeable odour. Upon the nature of that dust a good deal of speculation had existed. He thought it was very desirable that it should be ascertained what the exact composition of it was; he had been told that it contained muriatic acid. The employment of coloured calf binding was always more or less dangerous; but if one description was more so than another, it was the pale yellow calf, which had been referred to in the paper as the material chiefly used in the binding of legal books. He hoped this discussion would result in eliciting some valuable practical information on this interesting and important subject; and he trusted that this Society, which had already done so much for the objects which it promoted, would not let the question rest where it was. It was important to investigate the action which the various substances used in preparing the different descriptions of leather had upon its durability. Calf leather, as he had said, was unsatisfactory, and the result of his own experience was, that if the fancy-coloured skins were used in binding, a heavy bill for repairs would be the result. Looking back to the old folios bound in the Dutch calf, even under the adverse circumstances of the Athenæum library, it was found that the decay was merely a natural one from the long lapse of time; but modern work showed no such durability. He believed that the morocco leather was best adapted to withstand the effects of the combustion of gas, as well as of a heated atmosphere; and, as far as his own observation went, there was no binding so much to be relied upon, or so cheap in the end, as good morocco. With regard to the fitting up of libraries, if there was one thing he feared more than another, it was the constructing bookcases with undue attention to their architectural effect, which often involved the introduction of ornament likely to interfere with the convenient removal of the books from the shelves. He thought that shelves from three to four feet in length were a very good size, but this must depend on circumstances. In all public libraries there was one principle which ought never to be departed from—that was that every thing which was done should be done for the public convenience. All other matters should be subsidiary to that. The great point to be observed was a means of easy access to the books, without placing the visitors under the difficulty of having to climb ladders in order to reach them. Generally speaking he thought it a good plan to divide a library into stories, each about seven feet high, thus enabling the top books to be reached with ease. With regard to London, of which he spoke more especially, he considered one great point in connection with the preservation of the books, was to keep them within glass cases with moveable frames. Any one not accustomed to large libraries in London, would hardly credit the amount of dust and dirt that accumulated upon the books, which in damp weather became almost a pigment. With reference to the covering for the floors of libraries, he certainly was not in favour of Turkey carpets, as they held an intolerable amount of dust. In the British Museum the flooring was covered with kamptulicon, which possessed the advantage of being noiseless, and was easily swept and washed. He believed as yet no paper had been read before the Society upon the important subject—How to form a public library; and further, upon the best means of compiling the catalogues of large libraries. If the Society would take up those subjects, he was sure it would bring together a vast amount of information which was now scattered, and this would form an interesting event in the history of the literature of the country.

Mr. Harrison (of the London Library) would join in expressing an earnest hope that the Society would be induced to take up the subjects to which Mr Spencer Hall had alluded, as well as the question of the effects of the combustion of gas upon the bindings of books, for he confessed, notwithstanding the examples before his eyes of the destruction, attributed to that cause, that had occurred in the Athenæum library, he had lately recommended the introduction of gas into the extensive library under his care, hoping to avoid the dangerous effects alluded to by the use of cannel coal gas, which was of much purer quality than ordinary gas. The gas in the library to which he referred would be lighted only for a short time even in the depth of winter, the lights being extinguished at 6 o'clock. He was in some degree led to make this recommendation from having seen that the shops of all the large booksellers in London were lighted with gas, where there were bindings of great value. From what he had heard that evening, he confessed some fears had been created in his mind, and he felt that they should have to look to the Society for guidance in this matter. He thought public libraries should be lighted from the top, and that the galleries should be of sufficient width to receive a reading table, as it was most inconvenient to go up several flights of steps to fetch a volume and then to have to go down again to read it. He suggested that perhaps a good means of defence against the action of gas would be to return to the use of vellum bindings. He had visited several foreign libraries. In Italy, Spain, or France, they might naturally expect to meet with libraries carefully kept; but one of the most remarkable was the Imperial Library at St. Petersburgh, which was of great value, although it boasted but little in the way of fine bindings. It might interest those who were concerned in the classification of books to see the shelves in that library, with folios, quartos, and other sizes all together on the same shelf, attention being paid rather to the classification of the subjects than to the size of the volumes; but of course, that plan could only be carried out where space was of no consideration. He had seen a private library, near Moscow, in which were some remarkable specimens of the old French binding. Books brought from France at the time of the revolution, with the Bourbon arms still on them, and the splendid red morocco bindings were to be seen side by side with charred volumes that had been partially destroyed in the great fire at Moscow. In cases where the library extended to two floors of a building, he would suggest that a sketch of the ground plans of the library rooms should be placed in the principal room, indicating the position of every case, and the general nature of its contents. He would add one word to what had been stated by Mr. Spencer Hall with regard to the arrangement of space in libraries. This was to him a subject of much interest, having a growing library under his care, where, as the books circulated, a mode was adopted which was not very common. The books were perhaps arranged in classes, each class being placed alphabetically on the shelves; when a book was removed from the shelf, the vacant space was filled up by the insertion of "returned books" into their places in the alphabet, so that by simply shifting the volumes according to the exigencies of the day, the space left by the absent books was always in use, and a saving thus made to the library equal to the three sides of a large room. Another point alluded to by Mr. Leighton, was the mode of placing books on the shelves so that the dust would fall off them when taken down. He thought something might be made of that idea. It was mere habit to take down a book and open it laterally, but to make the plan effective, they would have to teach the world of readers how to open their books, or to the mischiefs arising from the present system would be added the disappointment of having a volume open the wrong way up.

Mr. G. F. Wilson, F.R.S., said Mr. Spencer Hall had asked for suggestions from members of the Society, with regard to the action of the products of combustion of gas upon the bindings of books, and, as one had occurred to him, he would mention it. Mr. Spencer Hall had stated that the leather he had found to be least injuriously affected was the morocco. Now, he believed, more oil was used in the preparation of morocco leather than in any of the other descriptions employed in bookbinding; and it was to be presumed that this would have the effect of protecting the leather from the action of the sulphurous or sulphuric acid. But he believed the oil itself in the leather was by long keeping affected by the action of the oxygen of the air, and he thought it would be worth while for some manufacturer connected with leather-making for book-binding to try the effect of some of the hydro-carbons, which were known not to have affinity for oxygen. There were many such oils now known. The oil of coal was produced now almost without smell; and there was also the oil from schist, or from petroleum, none of which were acted upon by the air, and he thought they would be worth attention.

Mr. Hyde Clarke said there was one point mentioned by Mr. Spencer Hall that deserved serious attention. That was with regard to experiments upon the different substances used in the preparation of leather for book-binding purposes. Mr. Leighton, as an artist, would no doubt remember the important experiments made by Sir Joshua Reynolds upon paints, and the record which he kept of every work he painted, from which a sound inference might be drawn of the value of any particular application. He had been much struck with the practical character of the observations of Mr. Leighton upon the art of bookbinding, and this had impressed upon his mind more strongly a subject which he was about to bring before the attention of the Society. In the proceedings of this Society there were many valuable papers on various trades and processes of manufacture; and perhaps there was to be found in the pages of the *Journal* information on particular subjects not elsewhere to be had; and he could not but think that if these papers were selected, classified, and re-published in a condensed form, they would constitute a work invaluable to the manufacturers and working classes of the country.

Mr. Atkins said in the discussion of the question of injury to libraries, it would be desirable to know how the library of the Athenæum was heated, and also whether gas was indispensable in large libraries. He thought the heat of the room, independently of the gas, had something to do with the injury to the bindings. He also thought that all receptacles for books ought to be periodically opened, to admit of the free circulation of air through them, and prevent the accumulation of damp.

Mr. Spencer Hall admitted that whilst the products of gas burnt in a library had a detrimental effect upon the bindings, yet that was by no means the only enemy of books. There was no prejudice against the use of gas, but the feeling generally was in favour of that mode of lighting, as it was undoubtedly the easiest and the cleanest, as well as the cheapest method. They must not assume therefore, that gas was the sole cause of the injury to the library, although no doubt, in the case of the Athenæum, it formed an important element in the matter. The general temperature of the upper part of the room was about 60 degrees, which he was informed was not destructive to leather. There could be no doubt that deleterious matters were introduced in the process of tanning the leather, as also in the process of binding, an instance of which was the application of oxalic acid to the leather used in the binding of legal books. The rooms of the Athenæum were lighted up in winter from about half past four in the afternoon until one o'clock a.m., which, together with the fires, kept up a large amount of continuous dry heat. At other club houses the books in the library had been destroyed in a similar manner where no gas was burnt, and where the dry heat alone was supposed to have occasioned the mischief. Mr. Aikin's opinion was sufficiently clear upon that point. With regard to what had fallen from Mr. Harrison upon the subject of vellum bindings, no doubt this material was very satisfactory, and, for a time, books so bound looked very well; but after they had been upon the shelves of a library in London for some time they became very discoloured and dirty. In other respects no doubt vellum was a very excellent binding.

Mr. Wheatley remarked that the deleterious effects of gas in libraries were probably enhanced from the fact that a larger quantity of light was given than would be the case with other modes of lighting, and consequently more heat. He had seen libraries in which oil lamps alone were burnt, and in others wax candles, and in both cases he had found effects as destructive to the books as those which had been attributed solely to gas. In the Alfred Club the books were in a very bad state; the covers fell away from the backs in the same way as was described to have occurred at the Athenæum, and he thought more investigation than had yet been given was necessary before they could throw the whole blame of the mischief upon the gas. With regard to the arrangement of small libraries, he thought the best way was to enumerate the cases by letters of the alphabet, and the shelves by numbers; but that could hardly be done in a large library without causing confusion. In one of the clubs the shelves had been numbered consecutively from 1 to 400, which he need not say had been found most inconvenient. In public libraries he thought there should be an ante-room in which the serial publications should be deposited, which would prevent disturbance of the other arrangements of the establishment. Upon the subject of glass-cases he slightly disagreed with Mr. Leighton, because in country houses the library generally remained closed for half the year; and upon the return of the family huge fires were lighted to air the house, and the effect was that, if the cases were not opened at such times, the books would mildew owing to the accumulation of damp. Mr. Wheatley added some humourous suggestions for the titles of imitative books in dummy doors, introduced for decorative purposes.

Mr. John Bethell said there was one matter in connection with the subject of the destruction of bindings which he thought had not been sufficiently noticed—that was the material that was used in cementing the covers of the books—namely, the paste. They had been told that evening that whenever books were subjected to a temperature most favourable to putrefactive fermentation—or about 70 degrees—whether gas, oil, or candles were burnt—the bindings of the books decayed. It was also stated, that books kept in a closed case, without proper ventilation, upon the introduction of an increased amount of heat into the apartment, were subject to putrefactive fermentation and decay. If they took some of the substances used in bookbinding—such, for instance, as the paste—and put it into the book-cases, they would find that it would very quickly show symptoms of mould and decay. And he would suggest it as a matter worthy of the consideration of bookbinders to adopt some description of cement which was not so liable to putrefactive fermentation as paste was—such as a solution of india-rubber or gutta-percha. He thought gas had been rather libelled in this matter of the destruction of bindings, for they were now told, that in libraries where heat was kept up, but in which no gas was burnt, the books were equally destroyed. The great evil appeared to be the high temperature that was kept up in the rooms, which was not only prejudicial to the books, but also to the readers.

Mr. John Rutley mentioned that for the preservation of pictures a mastic varnish was used, which was not affected by the combustion of gas; and which was readily cleaned with a piece of linen cloth. In rooms lighted with gas, deterioration was manifested very soon after the pictures were hung up, which was not the case in rooms lighted with oil or wax candles, no matter how high the temperature was.

Mr. Bone mentioned that he had found the "india rubber solution" to be a very excellent thing to extract oil or grease stains from books, whether bound in leather, silk, or cloth. It might also be used for removing similar stains from the insides of the books, as well as from furniture covers, carpets, rugs, &c. The process was very simple, and consisted in laying on a coat of the solution, and leaving it to dry; it should then be removed with a piece of ordinary india rubber. It was also very convenient for fixing prints in a scrap book, being superior to paste or gum, as it was sufficiently adhesive to firmly hold them, while they might also be easily removed at any time without damage to either scrap book or drawing, as the india rubber could be detached in the manner he had described.

Mr. Wilson had found great saving in the wear of the edges of the books in taking them from and replacing them upon the shelves by letting in a piece of india rubber at the front of the shelves, thus preventing abrasion of the edges of the books.

Mr. Leighton said that time would not permit him to enter upon a reply to the various matters brought forward in the course of the discussion, but he would take that opportunity of tendering his thanks to the numerous gentlemen who had favoured him with the various interesting specimens then exhibited to the meeting.

The Chairman said, on rising to prepare the usual vote of thanks to the author of the paper, he was quite sure that they would join with him in considering the subject one of great importance and of universal interest; because there was no person in the room—young or old—who was not more or less interested in books, and in their preservation; and now that books were being so rapidly multiplied, it became of the greater importance that everyone should be well acquainted with the best means of preserving them. It was almost impossible in the present day to avoid forming a library of some kind, owing to the great cheapness and excellence of the works now published, and which were brought within the means of all. With regard to the arrangement of a library, he had always admired the plan adopted at the Institution of Civil Engineers, for books in a large number of volumes. It consisted in having a small round label on the back of each, so placed that, when the volumes were in their right order, these labels formed a diagonal line, and thus if one volume was out of its place, this was at once seen. He thought the plan of preserving papers and documents by placing them between sheets of transparent paper a very valuable one. The subject had occupied his attention some time since, and he had made the suggestion to one of the secretaries of the Treasury, as an excellent means of preserving the writing upon copies taken by Wedgwood's manifold writer, as the writing, which was composed of carbon, would be thus effectually protected. As a material for bookcases, Mr. Leighton had spoken of the value of oak; and he (the Chairman) would mention that a Canadian wood called butter-nut had been recommended by Sir Walter Trevelyan as an admirable wood for cases for books, botanical specimens, &c. He had used it himself, and had never seen an instance of its being attacked by the worm. Mr. Leighton had alluded to the method adopted of placing the plates and maps of works in such a position as not to be readily compared with the text. A plan was formerly adopted in this respect, which he should be glad to to see again in use, namely, bringing the plates or maps when open, beyond the edge of the back. This remark was particularly applicable to large books like Johnston's Physical Atlas. It was a great drawback upon the value of that work that the contents were printed in the same volume with large and elaborate maps, and the difficulty of reference was very great. He thought, in expensive works, this was a matter deserving the attention of publishers. The subject of injury to libraries by gas was too important to be cursorily glanced at, and, therefore, at that hour of the evening he would not enter upon it, but they could not fail to be interested by the remarks of the gentlemen who had touched on that question. He had recently seen an announcement of an improved gas-burner, which might perhaps be found to mitigate the evil in some degree. In the country districts he had found that in libraries for working men the most durable binding was strong canvass. The books were used as long as they could be in the dress in which the publisher issued them, and were then bound with strong canvass, which was found to answer well. He would now make a proposition, which he was sure would be well received by them all, namely, the thanks of the meeting to Mr. Leighton, for the paper he had read.

A vote of thanks was then passed to Mr. Leighton.

The paper was illustrated by a large collection of books, showing various styles of ancient and modern binding, as well as the different modes of restoration and preservation described. Specimens of binding materials, skins, cloths, &c., were also exhibited, as well as instances of the destruction of library books, contributed by Dr. Letheby, Mr. Spencer Hall, and others, to whom the thanks of the Society are due, as well as to Sir Charles Price, Bart.; Mr. Robert Turner; Mr. William Stirling, M.P.; Mr. Bedford; Messrs. J. and J. Leighton; Messrs. Leighton and Hodge, and many other gentlemen; also to Mr. Ladd, who lent some microscopes for the purpose of showing specimens of the insect known as the "book-worm."

The Secretary announced that the paper for Wednesday Evening next, would be "On the Colouring of Sculpture," by Professor Westmacott, R.A.

The following letter has been received by the Secretary since the meeting:—

Sir,—It ought to be a leading point in arranging a public library to make the arrangement of the books on the shelves as nearly as possible a reflex of the alphabetic arrangement of the catalogue. There should be but one alphabet. The usual size of books, 8vo. and 12mo., may all range together, and that will be the bulk of the library, from ceiling to the floor—depth of shelf about 10 inches. I would have no small shelves at top, and large ones below; that causes confusion in the alphabet. The plan I follow is to make a separate division of shelves for 18mos. and 24mos., and also for 4tos. and folios, and then the librarian knows where to go for them at once, instead of poking about in shelves here and there. As to cataloguing, all books whatsoever should be arranged under the names of the authors. That is the only workable plan. The only books to be entered under their titles are those which are anonymous. But besides this arrangement in alphabetic order, there ought to be heads according to subjects, as Agriculture, Angling, Theology, History, &c. Under each of these heads, which are put in small capitals, may be entered brief references to works in the alphabet. For example:—

History of England and Scotland.

Macaulay—England.
Strickland—English Queens.
,, —Scottish Queens.
Hume—England.
Smollett—England.
Tytler—Scotland.
Laing—Scotland.

Such entries will at once direct attention to the special author and book wanted. I would refer to the catalogue of the Edinburgh Philosophical Institution for a perfect model in this respect, as well as in some other features.

I am, &c., ROBERT CHAMBERS.

Edinburgh.

Home Correspondence.

EVENING CLASSES IN MECHANICS' INSTITUTIONS AND GOVERNMENT AID.

Sir,—The meeting on Mr. Chester's paper was one of the most valuable of the session. I regret there was not time for the representatives of the Institution to take part in the discussion. The further consideration of the subject must now be reserved for the opinion of the conference in June. Westminster is the only metropolitan parish sufficiently enlightened to appreciate the value of Mr. Ewart's Free Library Bill. This Bill has been rejected by the City of London and the parishes of Marylebone, St. Pancras, Southwark, Islington, and Camberwell. It is a very difficult thing to overcome the inertia of parochial ignorance, and call people together to inflict a direct tax on themselves. Parishes reject the Free Library Bill because the tax is direct; if it were paid on receipt stamps or tobacco, or by any indirect means, almost every town in the kingdom would have had a Free Library. People resist direct taxation; and for the present whatever is done for education must be done indirectly. One difficulty attending Mr. Ewart's Bill is that a simple majority is not sufficient as in other local imposts, but there must be the assent of two-thirds of the ratepayers before the Bill can become operative. It is no use telling the infuriated ratepayers at a vestry meeting that the tax can never exceed one penny in the pound; it is enough for them to know that it can be a farthing.

The most important point raised in Mr. Chester's paper is the subject not of Government interference, as some spitefully call it, but of Government co-operation and assistance. Mechanics' Institutions, Working Men's Classes, and such like societies, are not the organization of any sect or party; and this constitutes their strength and their weakness.

For a long time Mechanics' Institutes were merely places of innocent recreation and amusement, with the useful addition of a library and news rooms. During the past three or four years the educational element has been very much developed,* and a large number of institutions now have classes for systematic instruction; this improvement is mainly owing to the Examinations of the Society of Arts. Now the amusements of the people will always pay and take care of themselves, but it is not so with the educational department of an institution; and experience leads me to the conviction, that as places of education, Mechanics' Institutions never can (except in a few rare cases) be self-supporting. I have taught in evening classes for years, and I have endeavoured to make myself acquainted with all the difficulties and drawbacks connected with them.

To talk about Mechanics' Institutions, as places of education, being independent, and repudiating all aid from the Government, sounds very magnanimous to people who profess to do everything for themselves, and I only wish it worked as easily as it sounds. You are to rely on voluntary efforts to meet all requirements; you may take any amount as charity from a private individual, but you must avoid, as a pestilence, any thing given by the Government. If you cannot afford to pay teachers, have voluntary teachers; they answer remarkably well in a Sunday School. If you cannot squeeze enough out of the poor lads who attend the classes to pay for gas, fire, and apparatus, get into debt. Go on in this manner as long as you can, break up, and then declare that these institutions are failures, and that the working classes care nothing about education. Now it would have been just as reasonable for the people of Westminster to have thrown themselves on the mercy of this voluntary spirit, instead of getting the force of an Act of Parliament to establish a Free Library.

The only difference between assistance from the Government and help from the local rates is this, the one is direct and hated, the other is indirect and not felt. In both cases the voluntary principle is repudiated. Those things which are for the general and public good, no one feels a direct and individual interest in promoting; all our national and many of our social reforms have to be enforced by the authority of law. It would be just as reasonable to throw the support of the poor on voluntary benevolence, as to expect a useful education for the children of the working-classes and the young men in our workshops, unless stimulated and encouraged by some certain source of aid dependent upon conditions clearly defined and easily carried out.

The most fervent hater of centralization and Government aid must admit that since the Minutes of Council, the elementary education of the country has greatly improved, and the professional ability of the teacher has been raised. But the universal complaint is, that the stern necessities of life compel parents to remove their children from school at a very early age. To remedy in some degree this sad misfortune, several plans have been suggested, but the most probable, and the one most likely to be received in good faith by the working classes, is that which encourages young men to continue their education in the Mechanics' Institution after they have left the Day-school. And if it be right in the Government to help the education of a boy while he remains at the Elementary-school, I see no good reason why that help should be withdrawn just at a time when the boy most needs it. Had he remained at school it would have been cheerfully continued.

Three years ago I published a plan by which I thought the Government might assist the education in Mechanics' Institutions in such a way as not to interfere with local authority. Let the Educational Department of the Government issue a schedule of such subjects as may be fairly aided by the State, and wherever 100 persons could be found prepared to undergo examination in any of these subjects, the authorities should send some person to superintend the examination, who should be responsible for its fairness and impartiality. I lay great stress on this, because I think such a duty, except in the direst emergency, ought never to be delegated to any local and comparatively irresponsible authority. Certificates of three grades should be awarded to successful candidates, with a medal or reward of books, according to the certificate or certificates obtained by the candidate. These rewards might be increased by local subscriptions; these and other collateral benefits might be held out as an encouragement to the pupils.

The teacher, in consideration of the number of pupils who passed an examination in the subjects taught by him, should receive a small capitation fee, in addition to a liberal share of the fees. The only conditions I would impose upon the pupil are that he had left the day-school, was engaged in some industrial occupation, was a member of some Mechanics' or analogous Institution, and had attended either at the evening school or Mechanics' Institution fifty hours instruction during the year in each of those subjects in which he proposed to be examined. By such a system the duty of the Government would be simply to test and reward results without what is called interference.

In a few years, I believe, we should be able to point to a national improvement more marked than any corresponding period in elementary education. The working classes would rise to a more intelligent appreciation of their moral and political duties. Their social condition would improve with an improved education, and this would more than repay the expenditure of such a system of aid as that I have indicated. After the first year I think there would be little difficulty as regards teachers.

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* Upwards of 5,000 young persons in Yorkshire are in regular attendance at evening classes connected with Mechanics' Institutions.

After the first examination of the Society of Arts, I took one of the pupils who had passed a good examination and made him an assistant teacher; in a short time he became quite competent to take the entire charge of the class. Such teachers may be raised up everywhere. You only want a guarantee that the teacher understands his subject and has fair teaching power. The best teachers will be found to be those taken from the class in which they have been taught. In the day-time my assistant worked in a shop with the apprentices and young men; he was engaged in teaching in the evening, and this is the true democratic principle of education, and ought to be encouraged. My assistant, so his employer informed me, was an excellent, steady workman; and, notwithstanding his superior attainments, he manifested no discontent, nor had he any desire to be a place-hunter, but as soon as he saw an opportunity to better himself he did what everyone does, availed himself of it; and he now writes from New York to say that he owes his advancement mainly to the evening classes at the Polytechnic, and forwards a small subscription to assist in carrying them on, which, as a matter of principle, has been returned. Unless the Government is prepared to offer some assistance, I fear this session will be the last of the Polytechnic Evening Classes. We have tried high fees and low fees. Our classes are not self-supporting, but, as regards numbers, they are very successful, and our pupils have done well at examinations. We have no sectarian zeal to urge in our behalf; we have no pulpits at our service; and to write hypocritical and pathetic begging-letters, or go from door to door with a charity-box, to be snubbed at one house, and insulted at another, is a humiliation to which we are not yet reduced. I would rather work for nothing than do this, because I think the principle a bad one. Old Snooks, the miser, escapes untouched, while the benevolent are too often taxed to a very shameful extent. The houses of the charitable are visited with all the regularity and confidence of the official tax-gatherer, while the houses of the stingy and niggardly escape without a visit. What we want is not this precarious and uncertain means of support, but a system which shall consolidate the Mechanics' Institutions and lay down a permanent system by which their educational character can be strengthened and developed. To help those who are desirous of helping themselves is the sound policy of this country in regard to national education.

I am, &c.,
J. C. BUCKMASTER.

St. John's Hill, Wandsworth, Feb. 22nd, 1859.

ELECTRO-PLATING ENGRAVED COPPER-PLATES.

Sir,—It is a tolerably well-known fact among those conversant with electro-metallurgy as applied to printing purposes, that engraved copper-plates have, since many years, been coated with silver and gold, for the purpose of protecting the plates from wear while being printed. In a letter from M. Joubert, in your number for the 11th inst., it is stated by that gentleman that the process of covering engraved copper-plates with zinc (as described by me) is an imitation of his process of covering similar plates with iron. Might I not, in equal fairness, challenge M. Joubert's process to be also, in the same sense, a copied idea? Assuredly; but to do so would be neither fair nor liberal.

The fact is that in this, as in most matters of a similar kind, adaptation is mistaken for invention. M. Joubert has undoubtedly by his *acquired* process greatly improved the practical means of a system already sufficiently well-known to *practical men*; but I conceive that it is as great a mistake to ascribe to M. Joubert or to M. Henri Garnier, of Paris, the full honour of an original invention, as it is for M. Joubert to call my zinc process an imitation of his *Acierage*, which it is not.

Besides gold and silver, zinc and iron are not the only metals which can be used for coating engraved plates. Nickel and palladium furnish beautifully polished deposits, capable of printing a greater number of impressions than I have given for zinc; while platinum, harder than either, can now be deposited in a *bright* state, and gives, as also in the case of nickel and palladium, a finer and (to use a technical term) *kinder* printing surface than any other metal. For this reason, either of the three may be advantageously used in preference to iron or other metals for the finest art-engraved copper-plates; and I state this especially in anticipation of the practicability of producing daguerreotype plates for printing purposes.

With reference to the question of cost, experience has proved that nickel and platinum may be deposited at the rate of less than one penny, and palladium twopence, per square inch. If ordinary care is observed in the preparation of the solutions, and in the manipulation, little trouble is necessary to verify these statements.

With regard to M. Joubert's comparison of the respective merits of the two modes,—that of iron facing with that of zinc facing, which latter I communicated,—I can only say, in conclusion, that for all practical purposes zinc facing, producible at an insignificant cost, and yielding 2,000 impressions from each coating, cannot be regarded otherwise than an important addition to the application of electro-metallurgy to printing purposes.

I am, &c., HENRY BRADBURY.

Whitefriars.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Rev. Henry Christmas, "On Shakspeare's Historical Dramas."
Actuaries, 7.
Medical, 8.
Geographical, 8½.
Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. Mr. R. Mallet, "On the Coefficients of Elasticity and of Rupture in Wrought Iron, in relation to the Volume of the Metallic Mass, its Metallurgic Treatment, and the Axial Direction of its Constituent Crystals."
Photographic, 8.
Medical and Chirurg., 8.
Wed. ......London Inst., 3. Mr. P. W. Brayley, "On Meteorology.'
Society of Arts, 8. Professor Westmacott, R.A., "On Colouring Sculpture."
Pathological, 8.
Pharmaceutical, 8.
Royal Soc. Literature, 8½.
Thurs. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Zoological, 3.
Royal Soc. Club, 6.
London Inst., 7. Mr. George Scharf, jun., "On Early Christian Art, as Exhibited in the Catacombs and Churches of Italy."
Antiquaries, 8.
Linnæan, 8. I. Mr. Baxter, "On the Vegetation of the Niger." II. M. Bourgeau, "On the Climate and Vegetation of Saskotchewan." III. Mr. Masters, "On a Monstrous Form of the Wild Carrot." IV. Mr. Spence, "On Five New Plants from Eastern Peru."
Chemical, 8½. I. Dr. Guthrie, "On some Derivatives of the Olefines." II. Dr. Medlock, "On the Action of Water upon Lead."
Artists and Amateurs, 8.
Royal, 8½.
Fri. ....United Service Inst., 3. Admiral Fitzroy, "On Meteorology."
Archæological Inst., 4.
Royal Inst., 9. Prof. Tyndall, "On the Veined Structure of Glaciers."
Sat. ......Asiatic, 2.
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February* 18, 1859.]

Dated 1st *January*, 1859.

14. M. Wigzell, Friar's Green, Exeter—An improved form of nail or driving article.

Dated 5th January, 1859.

42. W. Corfield, jun., Charlton-Adam, Somerset—Imp. in chains for coupling, cranes, cables, mining purposes, hoisting, and all other purposes where chains are used.

Dated 8th January, 1859.

66. W. Delany, Chicago, U.S.—Imp. in submarine boats or vessels, and in apparatus used for working under water. (A com.)

70. W. E. Newton, 66, Chancery-lane—Imp. in steam engines and steam generators. (A com.)

Dated 19th January, 1859.

169. W. Clark, 53, Chancery-lane—Certain imp. in boots and shoes, and in the machinery, apparatus, and means employed in such manufacture. (A com.)

Dated 21st January, 1859.

196. W. H. Morrison and H. Kinsey, Nottingham—Imp. in means or apparatus employed in the manufacture of bonnet-fronts, ruches, ribbon trimmings, and other goffered or pleated articles.

Dated 31st January, 1859.

273. D. Bentley, Accrington, Lancashire—Imp. in self-acting apparatus, applicable to letter-press printing-machines, for supplying and removing the paper.

275. T. Wilson, Birmingham—Imp. in breech-loading and other fire-arms.

277. H. J. Newcome, Shenley, Hertfordshire—An improved apparatus for heating or warming buildings.

279. A. V. Newton, 66, Chancery-lane—An improved method of extracting gold and silver from their ores. (A com.)

Dated 1st February, 1859.

281. L. Rigolier, Lyon Place Grolier No. 5, Rhone, France—A new brake for railway carriages.

283. S. B. Eveleigh, Salford—An improved form or construction of hats or covering for the head.

285. S. Plimsoll, 32, Hatton Garden—Mining apparatus for use in mining coal and other minerals, and also for separating the small coal and crushed ores from the shale, dirt and other matters with which it may be in combination, and for drying the same.

287. R. Gormully, 13, Grafton-street, Fitzroy-square—Imp. of pianofortes with upright frames.

289. R. A. Brooman, 166, Fleet-street—Imp. in sewing machines. (A com.)

291. M. Loam, Treskerby-house, Truro, Cornwall—Imp. in machinery for raising sewage and other waters and matters.

293. M. Henry, 84, Fleet-street—The manufacture and useful applications of certain bituminous products and compounds of bitumen with other matters, and treating and applying certain natural bitumen or bitumens for such purposes. (A com.)

295. W. E. Newton, 66, Chancery-lane—An improved blowing machine. (A com.)

Dated 2nd February, 1859.

297. E. Wilkins, 7, Addington-place, Camberwell, Surrey—Imp. in drain pipes and tiles for draining and liquid manuring land.

299. F. F. Rateau, 60, Boulevart de Strasbourg, Paris—An improved steam-engine actuated by regenerated steam.

301. S. Tearne, Birmingham—Imp. in ornamenting surfaces.

303. I. Clements, Birmingham—A new or improved method of manufacturing curtain rings.

305. G. Leach, Leeds—Imp. in leashing yarn or thread, in the hank, and in machinery for winding off the same.

Dated 3rd February, 1859.

307. T. Storer, Birmingham—A new or improved funeral carriage.

308. J. Woodrow, Oldham—Imp. in the manufacture of hats or covering for the head.

309. W. Clayton and J. Goodfellow, Blackburn—Certain imp. in metallic pistons.

310. H. C. Jennings, 8, Great Tower-street—Imp. in the manufacture of paper and artificial parchment and of gelatine, applicable to the sizeing of the same, and other purposes.

311. J. Petrie, jun., Rochdale, and T. Wrigley, Heap-bridge, Lancashire—Imp. in machinery or apparatus for washing rags, and other materials for the manufacture of paper.

312. S. D. Davison, Leith—Imp. in locomotive steam-engines.

313. A. G. Pooley, Globe Wharf, Rotherhithe—Imp. in preparing fish for manure, and in apparatus for the same.

Dated 4th February, 1859.

315. H. Greaves, 5, Victoria-street, Westminster—Imp. in the preparation of iron bars, of the various forms or sections used in the construction of sheet-iron structures, and in machinery employed for the same.

316. W. Thompson, 2, Rue Sainte Appoline, Paris—An improved printing telegraph.

317. A. Allan, Perth—Imp. in locomotive steam engines, in part applicable for retarding and stopping railway trains.

319. S. L. Trotman, Liverpool—Imp. for the more effectually securing or fastening envelopes or other like receptacles, and the more securely affixing postage stamps, or other adhesive labels.

320. R. A. Brooman, 166, Fleet-street—An imp. in cooling worts and beer. (A com.)

321. R. A. Brooman, 166, Fleet-street—Imp. in shirts. (A com.)

322. G. H. Baylis, 13, Vauxhall-walk, Lambeth, and F. Robinson, 88, Salisbury-street, Lisson-grove—An improved indicator for registering the withdrawal of liquids from vessels.

323. F. H. Maberly, Stow Market, Suffolk—Imp. in obtaining spring power, and in its application to various purposes.

324. L. Bonneau, 279, Rue Saint Denis, Paris—Imp. in apparatus for registering the time carriages are employed in conveying persons from place to place, and also in moving from place to place when occupied.

326. P. Adie, Strand—Imp. in apparatus for taking levels and measuring angles.

327. W. R. J. Packer, 4, Leinster-street, Dublin—Imp. in the plough or plough-share, for the purpose of more effectually pulverizing, breaking up, or cutting into small particles the earth or sod separated from the ground by the plough-share.

329. A. Barclay, Kilmarnock, Ayr, N.B.—Imp. in electric-magnetic or electro-magnetic telegraph ropes or conductors, and in machinery or apparatus to be used on board ship for laying or paying out the same.

Dated 5th February, 1859.

331. F. H. Maberly, Stow Market, Suffolk—Imp. in apparatus for corking, for drawing corks, in taps, in the necks of bottles, in the bung-holes of barrels, and in similar articles.

332. N. Greenhalgh, W. Shaw, and J. Mallison, jun., Bolton, Lancashire—Certain imp. in the treatment and preparation of yarns or threads previously to dyeing.

333. R. Tinkler, Penrith, Cumberland—Imp. in churns.

334. H. Anderson, Liverpool—An improved construction of apparatus for winding window blinds, sun shades, and similar articles on their rollers.

335. T. Sykes and B. C. Sykes, Cleckheaton, Yorkshire—Imp. in obtaining or separating oily, fatty, greasy, tarry, waxy, and resinous substances from oleaginous seeds, nuts and fruits, wool, silk, hair, cotton, flax, line, hemp, furs, skins, leather, bones, fish, and other animal matters and refuse, woollen and cotton waste and refuse, also textile fabrics and refuse grease, produced in various branches of industry, indigo, lac, lac dye, and other dyes.

337. M. Booth, Manchester, and J. Farmer, Salford—Imp. in sizing or stiffening woven fabrics.

Dated 7th February, 1859.

338. G. F. Chantrell, Liverpool—Imp. in the treatment of charcoal after its manufacture or revivification.

340. A. Lyons, 77, Chancery-lane—A pocket protector.

342. M. Curtis, Manchester, and J. Miller, Staley Bridge, Lancashire—Imp. in eertain mules for spinning cotton and other fibrous substances.

344. T. Sims, Conduit-street, Regent-street—Imp. in the application of photography to engraving and printing.

346. J. Smith, Bradford—Imp. in machinery or apparatus for preparing and combing wool and other fibrous substances.

Dated 8th February, 1859.

348. T. Moss, 69, Fleet-street—Imp. in the manufacture of paper and printing ink, suitable for bank notes, bills of exchange, and other documents requiring like security against being copied.

352. D. E. Bagnicki, New York—An improved syringing apparatus, for curing Leucorrhea and similar sexual diseases.

354. R. R. Rowntree, Kingston-upon-Hull—A portable tea testing apparatus.

356. J. B. Redman, New Palace-yard, Westminster—An imp. in the construction of carriage ways.

358. W. Clark, 53, Chancery-lane—Improved protectors for tobacco plants. (A com.)

360. J. Juckes, Dame-street, Wharf-road, City-road, Islington—Imp. in stoves or fire-places.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *Feb.* 18, 1859.]

February 18th.

1880. A. V. Pinta.
1887. W. F. Padwick.
1890. W. Smith.
1891. W. Pearce.
1896. P. Spence.
1897. J. L. Figgett.
1905. W. Henson.
2035. J. U. Faessler-Petzi.
2109. A. Turner.
2381. G. Kent.
2883. R. Mushet.
2921. R. Mushet.
2935. J. Broom.
2941. J. W. Child.

[*From Gazette*, *Feb.* 22, 1859.]

February 22nd.

1909. F. Puls.
1910. F. Puls.
1913. L. Higgins and A. Brown.
1917. J. H. Robinson.
1923. H. Wilson.
1927. T. Hill.
1933. J. Black.
1935. S. N. Rodier.
1938. T. Trotman.
1939. J. Ellisdon.
1943. H. W. Hart.
1995. J. T. Pitman.
2026. L. Pellissier & J. Puytorac.
2052. J. Knowles.
2061. L. Hill.
2089. Hon. W. E. Cochrane.
2222. J. Ridsdale.
2868. D. Rowan.
2897. J. Clegg.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette*, *Feb.* 18, 1859.]

February 14th.

391. E. Oldfield.
420. W. G. Merrett.
426. W. Muir.
438. J. Barsham.

[*From Gazette*, *Feb.* 22, 1859.]

February 17th.

431. J. Freer.
538. R. Maynard.

February 18th.

434. J. H. Johnson.
479. Charles Iles.

February 19th.

440. I. Moll.
442. J. H. M. Maissiat.
514. C. A. de Fonbonne.

Journal of the Society of Arts.

FRIDAY, MARCH 4, 1859.

EXHIBITION OF 1861.

The following letters, from the Registrar-General, and from Mr. Charles M. Willich, Secretary and Actuary to the University Life Assurance Office, have been addressed to the Council:—

General Register Office, Somerset-house,
16th February, 1859.

Sir,—I beg to acknowledge the receipt of your letter of the 15th instant, and to forward herewith, in compliance with your request, a statement of the estimated population of London at the periods mentioned.

I will thank you to state to the Council of the Society of Arts, that from the length of time which has elapsed since the last Census, I consider that *very little* reliance can be placed on these estimates, as it is possible that the assumption upon which they are based may be *erroneous.*

I have the honour to be, Sir,
Your faithful servant,
GEORGE GRAHAM,
Registrar-General.

P. Le Neve Foster, Esq.,
Secretary Society of Arts, Adelphi.

Estimated population of London, within the limits adopted for the Registrar-General's tables of mortality, at the undermentioned periods :—

At the middle of the year.	Persons.
1849	2,282,900
1859	2,774,300
1861	2,885,800

Note.—These estimates are based on the assumption that the population increased during the periods between the official enumerations and the above years, at the same rate as between the censuses of 1841 and 1851. Eight years having elapsed since the last census, it is impossible to say how far this assumption is correct.

Enumerated Population at the last Census, March 31st, 1851, 2,362,236.

GEORGE GRAHAM,
Registrar-General.

University Life Office, No. 24, Suffolk-street,
Pall Mall, S.W., 18th Feb., 1859.

Sir,—I have the honour to acknowledge the communication made to me on behalf of the Council of the Society of Arts, requesting my opinion "as to the probable number of young persons who," under certain assumptions, "it may be safely presumed will have grown into manhood in the years between 1851 and 1861."

I will endeavour to trace the progress of the population.

In the 10 years which will have passed from the Exhibition of 1851 to 1861:—

The survivors of the age	5	will in 1861 be	15	yrs. of age.
,,	10	,,	20	,,
,,	15	,,	25	,,
,,	20	,,	30	,,

And assuming that the population of London in 1861 will, according to the assumption made by the Registrar General, amount to 2,885,800, and if we deduct one-half[*] for females, 1,442,900, leaves 1,442,900 males.

In the mixed population of England and Wales, I find the per centage at the different ages was in 1851 as follows, and I am of opinion that the distribution of the population of 1861 will nearly coincide with that of 1851.

	Per cent.			
From 15 to 20	9·880	or in the Male Population of London assumed to be 1,442,900		142,558
,, 20 to 25	9·354	do.	do.	134,969
,, 25 to 30	8·170	do.	do.	117,885
	27·404			395,412
From 30 to 40	13·080	do.	do.	188,731
,, 40 to 50	9·818	do.	do.	141,664
	50·302			725,807

One-half of the population is, therefore, between the ages of 15 and 50, and able consequently to enjoy and to benefit by a renewal of the Exhibition of 1851.

It may also be observed that more than a quarter of the population[†] will in 1861 enter into the enjoyment of the great advantages the renewal of an Exhibition similar to 1851 will afford to them, many at that time being too young to appreciate the gain to be made by such displays.

I need not point out the vast numbers in the United Kingdom, within the limit of the above ages, who may also be improved by visits to a renewed Exhibition.

I have the honour to be, sir,
Your most obedient servant,
CHARLES M. WILLICH.

P.S.—The question has been limited to males, except *manhood* is intended to include *womanhood.* I am of opinion that the female visitors to the Exhibition will out-number the male.

To the Chairman of Council of the Society of Arts, Adelphi.

GUTTA PERCHA COMMITTEE.

Specimens of a gum resembling gutta percha have been forwarded to this Committee by the Secretary of State for India, with a request for their opinion as to its quality, and as to the probability of its becoming a valuable article of commerce. A careful series of experiments have been made upon this substance by Mr. Dugald Campbell, a member of the Committee, and a copy of his report, which was received by the Committee at their last meeting, has been forwarded to Lord Stanley.

Communications in reply to the circular issued by the Committee have been received from Malacca, through the Secretary of State for India, and from Jamaica, through the Secretary of State for the Colonies, as well as from other places.

The substance of all these documents will appear in a future number of the *Journal.*

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[*] In Great Britain, at the Census of 1851, the exact per centage roportion of males to females was—

Males	48·777
Females	51·223
	100·

[†] (27.404)

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Board has been appointed since the last announcement:—

For Holmfirth.

Mr. Thomas Arkwright, Schoolmaster.
Mr. Henry Brooks, Schoolmaster.
Mr. Thomas Joshua Brook, Registrar.
Mr. John Harpin, J.P., Birk's-house, Holmfirth.
Mr. John Hixon.
Mr. John Thorpe Taylor, Woollen Manufacturer.
Mr. Joshua Moorhouse, Holmfirth, *Secretary.*

The following letter has been addressed to the Local Boards:—

Society of Arts, Manufactures, and Commerce,
Adelphi, London, W.C., 3rd March, 1859.

Sir,—I am directed to call your special attention to paragraph 9 of the Society's Examination Programme, which is as follows:—

"9.—The Previous Examinations must be held by the Local Boards sufficiently early in the year to allow the results to be communicated to the Council four weeks before the 17th May, 1859, the day fixed for the commencement of the Society's Final Examinations."

I am, Sir, your obedient servant,
P. LE NEVE FOSTER, Secretary.

EXEMPTION OF INSTITUTIONS FROM RATING.

The following petition is about to be presented to the House of Commons:—

To the Right Honourable the Commons of the United Kingdom of Great Britain and Ireland, in Parliament Assembled.

The Humble Petition of the Society for the Encouragement of Arts, Manufactures, and Commerce, Incorporated by Royal Charter,

Sheweth,

That your Petitioners several years since formed a Union of the Literary Societies and Mechanics' Institutions of the United Kingdom, and that such Union now consists of upwards of three hundred of such bodies, with which your Petitioners are in direct and constant communication.

That your Petitioners have learnt that a Bill is now before your Honourable House, by which it is proposed to repeal, amongst other statutes, the statute of the 6 and 7 Vict., c. 36, by which land and buildings occupied by Scientific and Literary Societies are exempted from the payment of County, Borough, Parochial, and other Local Rates.

That the establishment of such Societies as aforesaid has tended materially to promote the education of, as well as a taste for science, literature, and art among, the masses of the people. That such Societies are for the most part supported by funds voluntarily raised by the people themselves; and your Petitioners are confidently informed that to withdraw from these Societies such exemption as aforesaid will not only lessen their means and seriously impair their efficiency, but, in some instances, actually cause them to be closed. Your Petitioners, therefore, humbly pray that the said bill, so far as regards the repeal of the statute of the 6th and 7th Vict., c. 36, may not be passed into a law.

And your Petitioners will ever pray, &c.

(Signed)
C. WENTWORTH DILKE, Chairman of Council.
P. LE NEVE FOSTER, Secretary.

Sealed with the Corporate Seal of the Society for the Encouragement of Arts, Manufactures, and Commerce, is third day of March, 1859.

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th April next.

Persons intending to be Exhibitors should communicate with the Secretary of the Society of Arts as soon as possible, stating:—

1st. The Title of the Invention.

2nd. Whether the Article will be a Model, Drawing, or Specimen.

The Articles must be forwarded to the Society's house carriage paid. The days fixed for receiving them are Thursday the 7th, Friday the 8th, and Saturday the 9th April. No articles will be received after the last of these days.

Articles which have been included in previous Exhibitions of the Society of Arts cannot be re-admitted.

Articles should be accompanied by a short but clear description of the Invention, with a wood block (when possible) for illustration, and a reference to any publication in which the Invention is described.

All Drawings exhibited must be framed.

No charge is made for space, and the admission to the Exhibition is free.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

THIRTEENTH ORDINARY MEETING.

Wednesday, March 2, 1859.

The Thirteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 2nd inst., the Very Rev. the Dean of St. Paul's in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Bentley, Capt. Frederick Stocks
Lawson, Walter
Moreland, Joseph
Scorer, George Castell
Sercombe, Edwin

The Paper read was—

ON POLYCHROMY IN SCULPTURE, OR COLOURING STATUES.

By Professor Westmacott, R.A., F.R.S.

In the paper I am to have the honour to read this evening, a question of practice in sculpture will be offered for your opinion and judgment. It is not my intention to occupy your time with the history of the art, or with any of its processes; but simply to discuss what may, in some respects, be considered rather a question of taste, though other considerations of higher importance are involved in the inquiry. It is one which seems, at this time, especially to call for careful reflection, and I am glad of the opportunity afforded me by the invitation of the Chairman of your Council, to bring forward prominently before a meeting like the present, when so many persons interested in art, scholars, antiquaries, and artists, are collected together, a subject which, I venture to believe, will be found well deserving their attention.

Owing to some experiments that have recently been made, it has been much canvassed whether or not statues should be coloured.

That the judgment we may arrive at will settle definitively the practice can scarcely be expected. There always will be persons who will claim to exercise their indisputable right to please themselves, both in the mode of producing and in estimating works in those imitative arts whose first appeal is to be made through the eye. But it is important, in its relation to the public education in art, that the opinions of those who have studied its history and theory should, if possible, be ascertained respecting any remarkable innovation, or inroad upon long established practice. It is the duty of those who profess art to watch over its character and interests; and if they have reason to believe that true principles are likely to be lost sight of, or tampered with, unhesitatingly to enter their protest, in order that the non-professional, and especially the promoters and supporters of art, may not be left without information and authority to direct them.

The study of the finest productions in the highest walks of the arts of design has led to the establishment of certain fixed principles, or *canons*, upon which the judgment of ages has determined that each art can alone be safely practised. These are not accidental and arbitrary regulations; they have been fairly deduced from the most perfect known works, whose excellence may likewise be proved to result from the presence of these elementary conditions. In the imitative arts of painting and sculpture especially, the proper limits of each have been well and carefully defined. Sufficient room has been left for the exercise of individual taste and fancy; but any great or striking deviation from these conditions becomes an infringement of the conventional, yet necessary, rules by which it has been determined that each art is, or ought to be, bound.

The expression of an individual opinion, whether of approval or dissent in the matter before us, will very inadequately meet a question which should be argued much more broadly, and should include the consideration of whether it is right or wrong to *paint* statues. As a matter of taste, or rather fancy, it must be left to the artist and the purchaser; but the inquiry should be made on higher principles than if it were only to test the value of a caprice. The proposition to be discussed is, Whether the practice is conformable with the principles upon which pure sculpture should be exercised.

The grounds upon which its advocates appear to found their recommendation of this practice shall, as far as I am competent to do it, be set forth fully and fairly. So far from desiring to press my own opinions presumptuously, my object is rather to elicit argument and information; and it will be my endeavour to conduct the inquiry in a liberal spirit, and with every possible feeling of respect for those who now stand forward in support of what appears to many an unnecessary, uncalled for, and, in some respects, dangerous novelty. A difference of opinion upon particular details of practice is quite compatible with the most sincere acknowledgment of the ability and talent of those from whom we may dissent upon insulated points. The object is to establish a truth, not to achieve a victory. But if it shall be shown that the proposed innovation is not in accordance with true principles of art, it becomes the more necessary to declare it against the opinions of those whose undoubted ability may be powerful to influence the public taste in favour of an objectionable practice.

It is fair to assume that the artists who propose to introduce painting or colouring statues, &c., conceive that such additions will *improve* sculpture. It would be absurd and unjust to suppose them capable of recommending it on any other ground; with the intention, that is, of injuring or deteriorating their art. When, therefore, they profess and show they are not satisfied to see sculpture practised in its simple speciality, as an art dealing with *form* only—a sufficient difficulty—it may fairly be taken for granted that they think it is deficient in some quality wanting to its perfection, and that they are able to supply this want, by calling in the aid of another art. It is to be lamented that if this is their feeling the proposition is not thus candidly stated, and that the Polychromists do not explain more fully and clearly than they have yet done the object they have in view, and the advantages they think will accrue to their art from it, because then the question might at once be argued on its merits. But the advocates for the practice of colouring sculpture appear to be either unwilling or unable to enter upon any art-reasons for its adoption. Generally, they are satisfied with saying it was done by the ancient sculptors, and desire to found the modern practice upon precedent. It scarcely is possible to conceive that this comprehends all the reason that artists of ability can give for desiring such an innovation on long accustomed practice. To advocate colouring sculpture upon no other ground than because ancient sculptors are said to have done it, seems to be simply a narrow prejudice. Before the general body of sculptors, and the public, who are not yet prepared to carry their respect for mere antiquity quite so far, can be expected to conform to the recommendation, surely the art-reasons for such innovation, and the principles on which the "colourists" found their new theory, should be fully explained. That sculpture among the ancients, Greek as well as others, was sometimes painted or coloured, and that it had other ornamental accessories, cannot be disputed; the fact is asserted by ancient writers, and what is still more important, monuments have been found so decorated, which place the matter beyond question and contradiction. This is freely admitted, but this authority, taking it fully for what it is worth—and some remarks will be offered further on upon some of the most generally received quotations from ancient authors, on this subject—no more proves the propriety or the desirableness of the renewal of the practice in the present day, and in the actual condition of sculpture, than the equally well authenticated fact of the early personages and characters of the Greek drama having smeared their faces with wine-lees, or concealed them under hideous masks, proves the propriety of sugggesting to our actors and actresses to do likewise.

Again, admitting the fact, and even the value of the authority of antiquity for Polychromy, it still may be questioned, first, whether painting or colouring statues was originated by any of the great masters of sculpture; secondly, whether the practice was the general rule in the best period of the art; and thirdly, whether it was employed by the best artists in their ordinary works; works, that is, not executed for a particular purpose and under special conditions; a consideration, it will presently be seen, of no slight importance in this inquiry. All these questions, bearing on the ancient authority, may, it is thought, be answered in the negative.

It may be permitted here briefly to state an art-principle which cannot be disputed: it may help to clear the ground for some subsequent remarks.

The legitimate province of sculpture is to represent by *form*. What is not represented by *form* does not come under the true definition of sculpture.

Therefore, if sculpture be painted it is, of course a mixture of *two* arts; as, if a picture be relieved or raised in any part, it is also a mixture of two arts.

Let it be imagined, that in order to increase the effect of some well-known picture, say the Transfiguration, portions of it were raised and sculptured, so as to produce the real relief or projection of the various figures and groups. Would it not be denounced, first, as a most inefficient device; and, next, an inexcusable departure from an established law of art? It is much to be lamented that, while no painter of reputation, ancient or modern, has attempted so to contravene an admitted principle in his own art, professors of the sister art of sculpture, many of them artists of unquestionable talent, as Bernini, Roubiliac, and others, have not always confined their practice within such wholesome and necessary restraint. On the contrary, they have indulged in endless heterodox fancies; though it must be added that, with all their passion for the fantastic and picturesque, the sculptors alluded to are not known to have had recourse to painting their works.

Having, however, admitted the fact that there is the authority of the ancients for colouring sculpture, it is now proposed to consider more at large the question, whether it is desirable to return to this practice. The incongruity or inconsistency of mixing together two arts, which the principles essential to each require should be kept distinct, has already been shown. The next inquiry will be, what are the objects proposed to be attained by painting or colouring sculpture?

1. Is it to render the imitation more close to nature?
2. Is it to attract attention?
3. Is it to gratify the sense by adventitious decoration?
4. Is it to give distinctness to the parts of a work when viewed from a distance. All these several questions deserve our attention.

First, with respect to close imitation.

It scarcely can be necessary to state to persons of any intelligence in art, that it is a radical error to suppose that it is in the province of the painter or the sculptor to effect an exact imitation; that is, such imitation as shall produce illusion. All know that, in many respects, this is impossible in sculpture. In others, where it is possible, the *fac-simile* representation of inferior objects, such as veils, napkins, the stuffs and materials of drapery is, as all practical sculptors know, simply the work of a careful carver.

It may not be out of place to state the principle by which the sculptor is, or should be, governed in this respect. It has been stated that there are certain objects in nature which do not admit of being exactly imitated in sculpture. This is undeniable. But even if it were possible to carry the imitation of that which is the highest object of the artist's study—namely, the human figure—to such perfection as to induce the belief that it was real: that to any one entering a sculpture gallery, the figures should so closely resemble nature that, at first sight, they should appear to be living men and women standing on pedestals, would not the achievement cause a very disagreeable impression? Undoubtedly it would. At present, the lover and admirer of art is gratified by the contemplation of a fine and successful work of art, *as* a work of art. His imagination supplies all that is wanting; and he does not ask or expect that his senses shall be deceived. Nay, the moment he could bring himself to look at it as a positive and exact imitation of a human figure: the hair, the eyes, the lips, the nails—every part coloured and tinted, like life, but without life, he would be more disposed to shrink from than admire it. It is easy to imagine the feeling with which we should contemplate such well-known works as the Apollo, the group of Laocoön and his Sons, the Farnese Hercules, the Fighting or Dying Gladiator, and other admired statues so treated. Even such a near approximation to reality as is afforded by wax-work exhibitions, is anything but pleasing to the generality of people, and especially persons of taste in art, though they may be amused by the talent and ingenuity shown in thus producing resemblances. It is not intended to insult legitimate sculpture by a comparison with bad common-place wax-work figures, but, in all fairness, to take the best that could be produced. Even if they could be the productions of first-rate artists the argument would equally apply. The dissatisfaction felt in this case, is to be accounted for on a perfectly intelligible principle. The reason for it is, that wax-work approaches *too near to nature* to be agreeable as *art*, and yet it is not near enough, or true enough to nature—nor can it ever be so—to make us forget it is *art*. There is no reason to believe that true Greek sculpture of a good period ever fell so low in taste as to have a school of close imitators of the kind alluded to, or that the introduction of colour on marble statues had any such object.

As it is always desirable, if possible, to refer to existing examples, I may notice that many sculptured works are to be found in this country from which a judgment may be formed of the effect of colour in increasing the truth of imitation. I allude to the painted monumental figures still existing in many of our churches. They are chiefly of the sixteenth and seventeenth centuries, though the practice prevailed in the earliest period of such monuments. Indeed, it is a remarkable fact, that the further we go back towards *barbarism* in art, or to the infancy of art, the more surely do we meet with coloured sculpture. Now these are legitimate examples of polychromic sculpture; and, of their kind, good examples: and, what is more to the purpose, they are infinitely superior, in this respect, to any ancient works of the kind that have been discovered. Probably, as they are of modern date, no value whatever will be allowed them; but had any figures or fragments resembling them been dug up in Greece or Asia Minor, there can be little doubt, judging from the examples that have been quoted, they would have been hailed by the Polychromists as invaluable specimens of the practice, and triumphantly adduced as authority for its reintroduction. And how do these affect us considered as works of art? Are not the best of them more suggestive of the toy-shop than the sculptor's studio? Among our obligations to the committee of artists who have so carefully arranged the various courts at the Crystal Palace at Sydenham, must be noted, especially, the opportunity they have afforded the public of judging of the effect of the employment of colour in sculpture and architecture respectively. Upon its applicability to the latter art it is not necessary here to offer any remark. Polychromy in architecture has received full attention, and has been most ably discussed by many eminent writers. But where painting has been applied to insulated sculpture (for the frieze of the Parthenon must be so considered as it is here presented to us), it surely is not asserting too much to say the bad effect it produces is quite enough to insure its unqualified condemnation. The experiment here made of the light blue background only, with the *rilievi* left in raw white upon them, is sufficiently unsatisfactory; but the grey, white, black, and brown horses, and their flesh-coloured riders, with their gilded heads of hair, all so admirable and so perfect in their simple art, are here degraded into tawdry toys. It is remarkable, also, that the figures appear now to have lost their symmetry, and the composition its unity, while all the finer qualities of detail in which they abound, are entirely obscured. By far the most successful works of the kind are to be met with in Spain, where statues, as large as life, and represented in action, are to be seen painted with the utmost care and finish. It is known that while this taste prevailed, sculptors laboured to acquire also the skill of the best painters, that they might themselves execute this adventitious work, and thus insure all the pictorial effect possible to their statues. As the artists of the time, the sixteenth century, were amongst the most able that Spain has produced,—as Cano, Montanes, Hernandez—these performances far surpass anything of the kind found in other countries, and the effect they produce at first sight is described, by those who have seen them, as perfectly startling. But, while giving them all due credit for the peculiar excellence they exhibit, several accomplished writers on Spanish art have not hesitated to record their unqualified condemnation of the practice, as opposed to all true principles of sculpture. But, to show the extent to which enthusiasm, and the determination to support any favourite theory may be carried, the ingenious author of a well-known treatise on Polychromy says, "*Si une figure coloriée avec art et avec goût ne fait pas bien, c'est la sculpture qui est en défaut et non pas la polychromie.*" This is certainly taking a somewhat unusual view of the position that sculpture might be supposed to hold in the question.

In the examples referred to the gradations are studiously marked in the colours applied; complexion, half-tints, veins, the eyes—all are carefully expressed. In the very few instances in which colour has been found on ancient sculpture, there is no attempt at gradation. The pigment is of one *uniform* tint, and appears to be laid on, or over, a thin coating of *stucco*, which covers, and of course must, more or less, clog and thicken the surface of the material of which the statue is formed. Some fragments of statues were exhumed at Athens in the year 1835, on which colour was found laid on very substantially. Among them was a female figure, of which the face, the eyes, and the eyebrows, were thus coarsely loaded with thick colour. In the official report of the discovery of the sculpture at Halicarnassus, a large portion of which is now arrived in this country, it is stated that colour was found on various objects. We have no opportunity of judging of it. It has so entirely disappeared that no trace of it can be seen; unless a very few spots of red in one or two parts may be considered to represent it. In ancient works the flesh where colour is found is usually expressed by a dark red; sometimes, judging from remains of colour on some works in Terra Cotta, it was white. In figures on vases this frequently occurs.

There are, however, some examples to be noticed of more carefully coloured figures and reliefs in this material (*Terra Cotta*). They are covered, in the same manner as those referred to, with a thin coating of *gypsum* or *stucco*, upon which various tints have been laid or washed, to imitate the flesh, hair, eyes, and drapery. So far, doubtless, they must be considered authority for *polychromic* sculpture. But too much stress must not be laid upon it. It must be remembered, in the first place, that these works usually are of small size, and were probably only made for decoration or household ornament. Also, that they are not so much examples of sculpture (proper) as of plastic art. Being made of clay, and then gradually dried and baked in an oven, they underwent a considerable change of form by the irregular contraction and expansion inseparable from these processes. This, of itself, proves that the refinement of surface and delicacy of form so essential in works in marble, were not cared for in these productions, and that their being coated with an extra covering was not considered of any importance. It cannot be supposed that the great sculptors in marble would have allowed the surface of their carefully studied and highly-finished productions to be so thickened and obscured by a coating of *gypsum* or any other material of the kind, in order to fit it for the *painter* to operate upon. The very idea seems preposterous, and to carry its own refutation. A process the marble did sometimes undergo, and to which particular reference will be made by-and-bye, was quite distinct from this material interference with the integrity of the surface.

Examples are met with of statues both in marble and bronze having the eyes of various substances, sometimes of glass or paste, sometimes metal, sometimes even of precious stones; and there are instances of inlaying metal of a lighter colour, as silver, on bronze lips. It is extremely difficult to account for such a strange caprice and perversion of taste, but one thing is obvious, namely, that no resemblance to nature could have been intended here.

It has thus been briefly shown that colouring sculpture is not desirable on the ground of exact imitation, and that the Greek sculptors of the best period of the art, who are quoted as authorities for the practice, never could have had that object in view.

The next inquiry is with respect to attracting attention. They who consider that the whole and sole object of art is to please the eye, may very consistently contend that all means that can be devised as conducing to that end are legitimate. They would, therefore, add extraneous decoration or ornament to sculpture in order to attract purchasers, by exhibiting to them either what is merely pretty or showy, or something that is calculated to excite or gratify certain feelings of mere sense. There have been, and it is to be regretted there are now, artists who are open to the reproach of doing this for very unworthy purposes; but it will be admitted, to their honour, that English sculptors are not liable to the reflection of making their art a means of corruption, by the studied display of qualities and modes of expression that can only be intended to minister to the grosser senses. But, where no such purpose is contemplated, a sculptor, jealous of his fame and of the honour of his calling, should be careful not to subject himself even to the suspicion of practising what might be termed trick or claptrap, as a means of inviting attention to his merits. It is, in fact, the mere chapman's excuse; and though there may be nothing absolutely morally wrong in this, it surely places him who adopts it in a somewhat different position from the class of artists to whom we should look for the maintenance of a high character for their profession.

The next subject of inquiry, namely, whether the object of colouring sculpture was to give distinctness to the several parts of a composition, will require a more extended consideration than has been given to the previous questions. In studying the practice of sculpture among the Greeks—those great masters of the art whom all the modern schools have agreed to take as their exemplars—it must be borne in mind that, without necessarily deriving their art originally from any other nation or people, the mode of presenting it would be much influenced by foreign usage, as the practice of other and, compared with themselves, more ancient and advanced nations became known to them. The report and example of what was done in other countries, especially in Egypt and Assyria, would reach them through various channels, and, considering the vast commercial and political importance of those old-established nations, would have great influence on a comparatively new people, especially of so quick and sensitive a temperament as the Greeks, and doubtless lead to the introduction among themselves of similar practices.

It may be observed here that there can be no doubt that painting with these earlier nations was in a great measure hieratic and symbolical. In figures of mythological personages, in kings and heroes, each colour so applied (and all are painted from head to foot), conveyed a distinct meaning, probably recognised by the multitude, but certainly understood by the priests, as having a peculiar application. We do not sufficiently reflect, in considering monuments of this kind, that sculpture had a much more profound meaning, and was fulfilling a much more important mission, in past ages than it has, or perhaps ever can have, with modern nations. It was not produced merely to gratify a taste for art, or to furnish galleries with pleasing objects of exhibition and display.

As, then, the custom of painting their sculpture prevailed among the older nations, and it is reasonable to believe that the accounts of travellers may have occasioned the introduction of the practice among the more recent settlers in Greece, it may be considered rather as a foreign graft upon their own primitive attempts at art. This supposition places the practice upon an entirely different footing to that which it would have had, had it been a peculiar feature in Greek design, and originated by the great Greek masters, when of course their taste would have been made responsible for its invention. Once introduced, however, usage gave it a hold upon the prejudices of the people, who, as sculpture at that early period was, for the most part, used for sacred purposes or illustration, no doubt soon closely associated all these modes of representation with the popular religious feelings; and thus, also, in the more barbarous ages of Greek art, painting the statues of the gods became a prescribed practice.

The intuitive genius of this remarkable people soon, however, improved upon the rude decoration of the less sensitive nations around them. In their polychromic architecture they appear fully to have equalled their exemplars in the richness of emblazonment, while they surpassed them in the delicacy of the forms of their ornament, in the appropriateness of application, the balance of quantities, and the judgment displayed in the several combinations and juxtaposition of colours; and thus, by their refined taste, they raised to the dignity of fine art that which among a less-delicately organised people doubtless was mere gorgeous and barbarous enrichment. It was the same in polychromic sculpture; and in studying its existence among the Greeks at the time of their best sculptors, it will be necessary, in order to judge fairly, to inquire how much of it was prescriptive, and how far the great masters of the art can be considered responsible authority for statue-painting.

The period when it is agreed, by all historians of art, that sculpture attained its highest perfection, ranges between 480 B.C. and about 200 B.C.; from the time, that is, when Myron and Phidias lived, and when the latter superintended the more important public works undertaken by order of Pericles, till the extinction of the immediate scholars of Lysippus, fifty or sixty years after the death of Alexander the Great.

Although an approach to a fine style of art is traceable in the schools immediately preceding the age of Phidias, yet there can be no doubt that, previous to the time of that great master, sculpture was still of a hard and exaggerated character. The sculptures from the temple of the Panhellenian Jupiter at Egina, among other valuable examples, indicate both these facts. Phidias, and those under him, effected an important revolution in art. He had the genius, and his favour with Pericles gave him the power to break through much that was prescriptive and traditional in sculpture; and, freeing it from these trammels, he produced what far surpassed all that had gone before it—as indeed it never has been equalled since—in the statues and rilievi which decorated the Parthenon at Athens. Still, the reformation was only partial. Imitation was indeed now founded on the close study of selected forms in nature, expressed in what is known as the grand style in art; but there is no doubt that the improvement or the change did not extend to some important details. Those liberties and innovations which Phidias suggested and effected in the general treatment of historical and poetical subjects, would not be permitted in the same degree in the representation of sacred personages. He would here find himself restricted by usage, from which it was neither safe nor lawful to depart; and it is recorded that the mere introduction of two portraits, said to be of Pericles and of himself, in the accessorial rilievi that decorated the statue of Minerva, subjected the sculptor to an accusation of sacrilege. In statues of the gods, then, we must not always expect to find the free, untrammelled production of the artist; but even where great improvements may be traced in some important points, be prepared to see some characteristics preserved of the original types. The priesthood, always alarmed at any change indicative of the exercise of individual and independent thought, required a strict conformity to established forms. Any very sweeping innovation in the mode of representing the gods might have shaken the faith of the common people in the religion itself, and then, of course, as a necessary consequence, in its teachers and ministers. In this respect, there was policy in their insisting upon his closely adhering to certain received dogmas in art. In obedience therefore to the universal feeling, Phidias made the statues of Jupiter at Elis, and of Minerva at Athens, of various materials, and they also were coloured in parts.

It has been asserted, to strengthen the case of the Polychromists, that Phidias employed his half-brother Panænus, a painter, "to colour his statues." The sole authority for such a general conclusion is a short passage which occurs in Strabo, the 8th book, in which allusion is made to Panænus having assisted Phidias "in many things," in his statue of the Olympian Jupiter; but as we know the figure itself was of ivory and the drapery of gold, and nothing whatever is said upon the important special fact of colouring the statue itself, it seems probable that Panænus could only have been employed, as a painter, on some inferior accessories.

Moreover, we must bear in mind that the works referred to were the offerings of a grateful people for most important victories achieved over a powerful enemy who had threatened their very existence as a nation. They were to be made out of the *spoil* taken from the vanquished foe. The Minerva especially was voted to crown the triumph over the Persian hosts, after the failure of the expedition into Greece under Xerxes. The accustomed means, namely, the employment of rich and varied materials, were, of course, adopted on this occasion. Ivory and gold, painting and inlaying, and every enrichment, were lavishly bestowed in order to make these votive statues the most costly of dedicated gifts. But *chryselephantine* and *polychrome* sculpture were not first known or invented at this time, nor was Phidias the first sculptor, by many, who practised it. He merely followed in the established routine. Fortunately for art the greatest sculptor who ever lived illustrated Greece at this period; and thus it happened that the richest works in material, were also, by a happy accident, the most perfect productions of art; but surely no one would attempt to argue that they were the most perfect works of Phidias in sculpture *because* they were composed of gold, ivory, or any other particular material, or because they were painted and enriched.

It is not necessary to describe these works in detail, but it is difficult for the imagination to conceive anything more splendid and gorgeous than the effect of their varied enrichments, viewed in combination with fine architecture, the details of which were also richly coloured, and glistening under the bright sun and cloudless sky of Greece. The most poetical fancy would probably fail in attempting to picture to itself the real brilliancy of the scene, taken as a whole. But, as critics, let us not lose sight of the important fact that we are judging the works alluded to only in a large combination—as objects of *spectacle* and display. Does it follow that, considered individually, as works of sculpture, the variety of materials and the flutter of colour would not be injurious to them, as these attracted admiration, instead of its being drawn to those finer and simpler qualities which should specially claim attention in this art. The fact is, the sculpture so applied lost its distinctive or special character. It was a portion of an architectural effect. Colouring, we know, was extensively employed in architectural decoration, and when the sculptor was called upon to act in combination with the architect, his work, no doubt, was subject to the same laws of treatment as other parts of the composition. He placed his groups in the pediment with its enriched coloured mouldings against a background, sometimes painted blue—perhaps to imitate the sky, but quite as likely merely to give increased distinctness and relief to his figures. He further increased their effect, as portions of a general design, with gilding and other accessories, and, no doubt, also sometimes with colour. But in all this, his object was to make his sculpture assist the whole effect. In short, it became necessary to adapt the sculptures, in colour and in finery, to the objects around them; so that in fact, as we are now considering it, instead of a principal, it became a subordinate and only ministerial accessory.

The necessity for giving distinctness to the several parts and minor details of a work which was to be viewed from a distance, would no doubt also be considered a justifiable ground for colouring sculpture. Many objects would probably be so placed that, in their unassisted simplicity of uniform colour, they could not be judged of, nor would they under some possible conditions be sufficiently separated or detached from the architecture to be seen at all. The treatment of the frieze of the Parthenon, one of the finest examples of the class of art existing, illustrates this speculation; while the peculiar technical treatment of these bassi-rilievi shows how deeply the ancient artists studied the various requirements arising out of such circumstances in the preparation of their works. I need not speak of the peculiar flat execution of the sculpture, but will observe that the darker and decided colour of the background—for it appears on examination that even now there are remains of blue colour discernible—may be accounted for as a means for giving distinctness and relief to the horsemen and other figures in the procession. The reason for such adventitious aid to their effect will be found in the position this frieze occupied in the decoration of the temple, and, in consequence, the peculiar quality and limited quantity of light it could receive.

Now, so far as we have proceeded, the only two intelligible grounds for the introduction of colour in sculpture among the Greeks seem to be, first, to assist in giving completeness to architectural effect, and, secondly, to insure distinctness to the parts of the sculpture itself. No one will argue that in either case the object of the artist was to give to the sculpture itself something it required, or was in want of for its perfection.

It remains now to make a few remarks on the ancient written authorities for colouring (Greek) sculpture. In the first place, the presumption is very strong that the assumed fact that the finest Greek sculpture, except when it formed a part of an architectural design, was ever systematically coloured, rests on very questionable foundation. It is rather taken for granted from certain vague expressions of comparatively late writers than proved from contemporary authority, or from any experience we have of the fact as a matter of universal custom. Pliny and Pausanias and a few other writers, living long after the date of the sculptors whose works they refer to, mention some so treated; and modern critics, few or none of them practical artists, have founded various speculations upon these imperfect data. It certainly is remarkable, if the practice ever prevailed to the extent that is pretended, that, among the very large number of marble statues of a fine period of art that remain to us to attest the indisputable superiority of the ancients in sculpture (proper), there is not a single tolerable example of the practice alluded to. It will not meet the objection to say this is owing to the great age of the works, and the accidents to which they have been exposed, for many of them have been found under circumstances that have insured their integrity a sufficient time to show the original surface. Besides, there was a period when the works of the ancients were studied and imitated in Rome with the most scrupulous exactness. The chambers of the Baths of Titus and of the Villa of Hadrian have given their long-concealed and well-preserved treasures of art to the light, after preservation from injury for centuries; and while the colours of paintings on walls have been found as bright and fresh as when they were executed, none of these even comparatively late works in sculpture have been found painted, or showing any indication of colour, in the way the admirers of *polychromy* have pretended. There is no intention here to deny the mere fact that colour was sometimes employed, but only to dispute the universality of the practice, and its being usual in the best period of sculpture.

The poetical and fanciful imaginings of certain writers have no doubt been accepted by some modern commentators who have little or no practical knowledge of art, as a statement of facts, and this has led to considerable misapprehension. As artists have not always the time or opportunity to inquire or examine for themselves into the value or correctness of the statements made to them, they are often led astray by incompetent connoisseurship, and some are thus unfairly influenced to adopt, as established usages of the ancients, practices which, if they ever obtained at all, were only partial and exceptional.

A few examples of accounts of statues, improved or embellished by the authors who describe them, will illustrate the character of some of these so-called authorities, and a very little reflection will show how little such descriptions can be relied on.

A sculptor named Aristonidas is recorded by Pliny as the author of a bronze statue which represented Athamas sitting, overcome with remorse, after the murder of his son. In order to express with greater truth the effect of confusion and shame, the artist mixed iron with the bronze, and this, "by its redness shining through the bronze," caused an appearance on the surface like a *blush.* Now iron is not red, to begin with; and then the redness is described as shining through the "*nitorem*" of the bronze, as though bronze were a transparent material.

Again, another ancient authority, Plutarch, is quoted as recording that Silanio (an artist who lived about 320 B.C.) made a statue representing Jocasta dying, and that by a peculiar mixture of the metals used in the composition of this work, a cast of *paleness* was given to the countenance.

It is scarcely necessary to say that these accounts are utterly undeserving of credit—so far as they assert that those expressive tints were produced by any possible mixture of metals; for the term used is "*miscuit,*" "mixed together." Any one who has the slightest acquaintance with metallurgy must know that the effects thus described are incompatible with the *fusion* of the different metals used for bronze statues; and even supposing, for the sake of argument, the possibility of keeping the metals distinct in a common melting, how then would it be possible to insure the blush or the pallor coming in the right place? It would not be easy to determine the precise colour that such materials should assume when they are intended to represent such refinements as the *complexion* of persons under the influence of strong emotions; but we have yet to learn that the addition of *red* cheeks or a *pallid* countenance would be an improvement to a *bronze* statue; and further it might be asked, would *red* be the colour of a blush in a bronze cheek? It is probable that such works as are here described, never had any existence but in the imagination of the writer. The fact of one of these authors mentioning the peculiarity of the work alluded to as an "*on dit*" rather strengthens this opinion; for Plutarch does not, as is generally assumed, describe a work he had seen, or that even existed in his time. Its reported author lived between three and four hundred years before the birth of Christ, and Plutarch not till nearly one hundred and fifty after that event, thus comprising an interval of between five and six centuries. Considerable allowance must therefore be made for those who presume to entertain doubts. "They say," or "it is said," cannot, in a practical matter like this, where there is no adequate contemporary testimony, nor any remaining monuments, be received as all-sufficient evidence or authority. In the other instance alluded to, of the statue of Athamas, Pliny says "*hoc signum extat Thebis hodierno die*," but he does not say he had seen it.

Callistratus describes, among several similar examples, a Cupid, the work of the celebrated Praxiteles. In enlarging on its claims to admiration, he says there was on his cheeks a vivid blush.

In marble statues the colour might be put on; but this, as has been been briefly shown, must have been done very coarsely and almost in patches. Pausanias mentions various works of the kind painted with vermillion. Among others he speaks of a statue of Bacchus that was made of gypsum, and painted—another of gold, or gilt, with the face painted red.

I will venture to add one more illustration from M. Quatremère de Quincy's celebrated work, in proof of the inadequacy of ancient authority, or that which is quoted as such, to establish any fixed doctrine upon this contested subject. There was a statue of a Bacchante, attributed to Scopas, who held, instead of a thyrsus, an animal (a kid) with its entrails exposed; the marble represented the livid flesh, and one sole material offered the imitation of life and death, &c.:—"*Erat autem illud capellæ simulacrum lividi coloris. Etenim saxum cadaveris quoque induerat speciem, namque et eamdem materiam in mortis et vitæ imitationem diviserat.*" The *commentator* on this passage supposes here, says M. Quatremère de Quincy, that Scopas had availed himself of a vein of marble which he found resembled the colour of the dead animal: "*Nempe in marmor incidisse artificem aliquâ parte lividum, quam partem ille cautè in effingendum capellæ mortuæ imaginem verteret.*" M. Quatremère de Quincy at once protests against this far-fetched explanation. He perceived in a moment its absurdity, or, at least, improbability, and enters into particulars to show that such an account of the wonders diplayed in this work was quite inadmissible. He truly says, "*Cette hypothèse pourrait bien n'être qu'une méprise*"—and then goes on to say, "*Il est plus simple d'imaginer*"—something else—and gives his own ingenious but quite as fanciful speculation as to how the performance was accomplished.

Now the above are some of the leading authorities upon which stress has been laid for the facts of the ancients having *habitually* coloured their sculpture. Can it be seriously proposed to establish a general practice upon such doubtful expressions and insulated examples as these, and then to call it the authority of the ancients? As reasonable would it be to take the authority of antiquity literally, and to affirm that living busts could be produced out of blocks of stone, or that bronze may be made to breathe, because we find in ancient writers such expressions as "*vivos—è marmore vultus*," or "*spirantia—æra*," or believed that pictures and statues lived, because it is said—

> "Et cum Parrhasii tabulis, signisque Myronis,
> Pheidiacum vivebat ebur—"

with endless other instances of the kind.

The descriptions of statues by Callistratus are certainly very curious and interesting. But where, in addition to the practical difficulty referred to, there is no concurrent testimony of the time, and not a single ancient fragment of a statue, such as he describes, to support his marvellous accounts of blushing *bronze* cheeks and glowing countenances, indulgence must be granted for the incredulity of those who cannot give entire faith to his statements. There is no intention to deny that the *statues* were produced by the artists to whom they are attributed. It is only suggested that the extraordinary accompaniments of *fused* colours, and the almost imperceptible gradations of delicate tints, must have been supplied by the elegant and poetical fancy of the writer.

It is necessary now to refer to one of the favourite and most frequently quoted authorities for the fact that the great sculptors of antiquity, after they had finished their works, employed artists to paint them. It has been boldly asserted that the "*circumlitio*" alluded to by Pliny, in the following passage, means painting: "Praxiteles, when he was asked which of his works in marble he valued most highly, said, 'those to which Nicias had put his hand;' so much value did he attribute to his '*circumlitio*.'" Now here is not one single expression that can be twisted into meaning painting, or colour; and certainly the passage cannot by any ingenuity be made to mean such painting or tinting with *different* colours as painting-sculptors are advocating. The great probability is that it refers to a most careful perfection of surface; both by giving a certain degree of finish or even polish to the marble, and probably by rubbing in a preparation—possibly a varnish—capable of imparting a rich roundness or appearance of fatness, so to call it (the "*morbidezza*" of the Italians), to the execution; and, anticipating by this process the mellowing effect of age. But even then such a general tone cannot be considered in the category of *colour*, as is now proposed to use it. It has been imagined by some writers that the varnish described by Vitruvius was intended to be applied over paintings and other works simply in order to preserve them.

To recapitulate in a few words. So far from denying that the ancient statues were sometimes coloured or painted, the authorities for the practice have been fairly produced and considered in this discussion. The mode of effecting the colouring has been shown, also on ancient authority. With respect to its application to productions in bronze, the marvellous effects of which have been as eloquently described, it has been shown that the authority for it is of very questionable value, and that the statements, if there be any truth at all in them, must be exaggerations. In colouring other works we now know how it was done. The description of ancient writers has been confirmed by modern discoveries; especially by the fragments that were found, as has been stated, a few years ago at Athens, painted thus coarsely, without variety or gradation of tint. Doubtless, when colour was employed on marble this was the ancient practice.

It has been objected, in reply to the arguments brought forward against statue painting, that the advocates for painting sculpture do not intend to adopt or imitate this wholesale and crude colouring, nor do they intend closely to imitate nature. It is said it is not proposed, now, to cover statues thus coarsely and entirely, but only to introduce, here and there, delicate tints, mere indications of colour in some parts; as the cheeks, the hair, the eyes (the colour of the eyes being different from the colour of the cheeks—and yet the imitation of nature not intended!). But surely this is proposing to do under the professed protection of the authority of the ancients what the ancients did not do. The advocates for colouring sculpture must in candour admit, that, whatever opinions may be entertained as to the desirableness of the practice, there is not the most remote hint in any reliable written authority, nor in any recovered fragment or work of art, to indicate that this delicate and partial tinting was the ancient practice, or was ever resorted to, even exceptionally, by any of the great masters of the art—as Myron, Phidias, Praxiteles, Alcamenes, Lysippus.

And even had it been employed, what would have become of all this tinting after the lapse of ages? Yet do we feel or fancy that the existing works of the best Greek schools, however we may deplore the mutilations consequent upon age and accident, seem to require such accessories? Do we feel that the Theseus and Ilyssus, the Venus of Milo, the Apollo of the Belvedere, and others, show a deficiency that colour could supply? Or in the modern works, do we feel any regret that the Moses of Michael-Angelo, the bronze Mercury of Giovanni di Bologna, the Christ of Thorwaldsen, the Hercules and Lycas, or the statues of the Popes by Canova, or the Michael and Satan of our own Flaxman, are without this embellishment; or believe they would be improved by receiving it? The modern sculpture-Polychromists would then introduce an entirely novel practice. They may endeavour to gain converts to a new system; but it is scarcely fair to profess they are, in this respect following in the steps of the masters of Greek sculpture. But suppose this attempt to colour sculpture should become the fashion, the delicate tinting of marble statues would necessarily act as a prohibition to the multiplication of favourite works. No sculptor who had devoted time and study to the delicate painting or colouring of his sculpture could contemplate with any degree of complacency the soaping and oiling it must undergo in order to its being moulded. Thus private collectors, galleries of art, schools of design, would be deprived of the advantage and pleasure of possessing fac-similes of possibly very fine productions in sculpture. This may be thought a trifling objection, but it is one of some importance to those who admire fine works of art, but are unable to acquire a gallery of original statues.

I have felt obliged, by the character of the arguments put forward by the advocates for painting statues, namely, the value of ancient authority, to make that the chief object of my attention. I have presumed to question its force and its universal application to sculpture (proper), though fully admitting the fact of polychromic *ornamentation.* But if its supporters should think their favourite ancient authority more distinct and decided than has been here allowed, and that the practice of colouring statues was universal and habitual among the Greeks twenty centuries ago (for the period of the greatest Greek sculptors was between five and three hundred years before Christ), is it, after all, a sufficient reason for our doing it as mere copyists? If imitations of ancient statues and ancient ideas, so far as they can be conceived independently of all ancient association or sympathies, are required, then, where it is desired, let all these presumed appliances be added; but surely it would be mere pedantry to insist upon them in the application of sculpture to the requirements of a people, of whatever civilised nation, who differ altogether in their religion, poetry, feelings, and habits from the ancient Greeks, and this only because the ancient Greeks are believed to have employed them. What hope can there be of ever succeeding in popularising art, and making it the expression of real sentiment and living thought, if we are systematically to ignore our own age and its wants, and only to put it forward mechanically, as the academic expression of factitious Greek sentiment, in such classic guise as museums and galleries of ancient sculpture suggest?

The argument that this new process might be found *pleasing* has not been openly put forth, the professed ground of its proposed introduction being always *ancient authority*; and we are, therefore, scarcely called upon to discuss that secondary question. But it may be as well to be prepared for that plea. The first inquiry in that case should be, who is to be pleased? Pleasing a particular age or party is no proof of the taste being correct. The history of art affords, or should afford, sufficient warning that fanciful innovations and caprices of practice not founded on principle, although at first they may have had admirers and patrons, have always failed to secure a permanent footing, and this even when, as has often been the case, their promoters have been artists of high reputation. What, for example, could be more pleasing in the popular acceptation than the productions and style of Giovanni di Bologna, of Bernini, and of Roubiliac? These were all men of unquestionable genius and great power in art, who, in their own time, were loaded with honours, and reaped the substantial reward of universal popularity, and left crowds of imitators behind them. It is not overrating them to assert that the best productions of these sculptors will bear comparison in invention, originality, knowledge of form, and execution, with anything the more modern schools have to show. And now, with all their indisputable merit, for no one can deny them this character, how are their works looked upon, and in what manner are they referred to?—As warnings to students not to indulge in fancies that are opposed to the principles of pure art. We have not now to learn that contemporary favour or popularity is no security for future fame; and it is remarkable how surely, sooner or later, false taste meets its fate.

A strange reason has been given by some advocates for Polychromy for the objections that have been felt here against the proposed introduction of painted or tinted sculpture: namely, that we are not accustomed to it in England. In what country, it may be asked, are they *accustomed* to it?

I hope I may be pardoned for offering, in conclusion, some few observations upon a collateral subject, which has forced itself on my attention during the inquiry into the mere art-question. It is far from unimportant; and I cannot doubt that if my apprehensions are well founded, the higher class of Polychromist sculptors, and its advocates among amateurs, will agree with me in deprecating the evils which seem to threaten art by the introduction of what is at present an almost untried experiment.

There is no surer indication of the decadence of good taste in art, and it leads to the decline and fall of art itself, than when, after a considerable degree of excellence has been attained, a passion arises for elaborate execution and ornament. What in one age is only the effect of ignorance, in another indicates corruption. The history of art, ancient and modern—for its rapid decline, even in Greece, is very remarkable—supplies us with ample evidence of this, and it is unnecessary to enlarge upon it, or to detain you while proofs are advanced in support of an indisputable fact. Barbarous and uncultivated nations in their earlier attempts at art adopt all the means that occur to coarse sensibilities to give effect to works of imitation. The employment of colour in sculpture is amongst them. In the same way, in a more advanced condition of society, when in any exercise of ingenuity or art (and it applies also to poetry and literature) a high degree of excellence has been attained, a desire of change arises; some fresh interest is anxiously looked for, and the fancy requires gratification in novel excitement. Nor is it, in art, confined to those meretricious *accessories* which have been chiefly considered in the foregoing remarks: kindred *subjects* may also be looked for as the natural consequence or development of a taste for sensuous treatment. This is a fast-growing evil in a neighbouring school of art, where sculptors of indisputable high talent are constantly putting forth works of the most objectionable character. It should be remembered, that in the period of what has been termed the sublime style of sculpture,—that of Phidias, who was distinguished as the worthy sculptor of the gods, and the beauty of whose works was said to have added something even to the dignity of religion,

> . . . Adeo majestas operis Deum æquavit,

it is believed the female form was never represented without its becoming drapery. It seems to be established that it was after his era that this fresh stimulus of the senses was introduced; and the undraped female figure has been exhibited from that time amongst the commonest subjects of imitation. The lessons of history should not be read in vain. Sculptors should strive not to allow their art to degenerate into a possible means of corruption. They must know how very few who contemplate undraped statues can have the necessary knowledge to form anything like an accurate judgment upon their merit, their truth, and the higher technical qualities of the art, and consequently, that such works can usually only address the sense, and not the understanding. They, as guardians of, and caterers to, the public taste, should avoid and protest against any innovations which, by possibility, may have a tendency to deprave that taste, or to lower the high standard of art. The class of subjects likely to be preferred for the more favourable exercise of the style of embellishment we have been considering will soon show the direction from which danger may be apprehended. The attention of sculptors will not be given to heroic representation, or to subjects that are calculated to suggest ennobling thoughts, but rather to those of an opposite tendency, the sensual class. Even assuming that the ancient classical mythology will, as usual, be the field of illustration, sculptors will scarcely choose the manly and developed forms of a Hercules, a Theseus, or an Achilles, for this delicate tinting or colouring, but will naturally prefer the soft and voluptuous female form, as Venus, Nymphs, Bacchantes, Dancing-girls; or the celebrated courtesans of antiquity, the Glyceras, the Phrynes, and Laïses of the olden time, with no stinted exhibition of their imagined charms: or if male subjects are selected, those of the class of Cupids, or young Bacchuses. Such subjects lend themselves especially to the attractive accompaniments proposed to be introduced; namely, the delicate tinting of flesh, painted cheeks and red lips, but which would appear out of place—nay, probably, even very offensive in representations of the more virile character. It is surely not too much to say that a male statue, such for instance as the Farnese Hercules, or the Barberini Faun, or even the Belvedere Apollo, if presented to public exhibition in flesh tints, with the hair painted, and the eyes coloured, however delicately and carefully this might be done, would not for a moment be tolerated. Would any father willingly take the females of his family into a gallery so peopled? It may be said, this is putting an extreme case; but the objection is a sound one, and it is not easy to define where the line is to be drawn. The feeling of prejudice which some persons entertain with respect to exhibitions of so called "classical" sculpture, and which it is impossible to blame where nude displays are made apparently only for the sake of exhibiting the naked human figure, would have ten-fold force under such circumstances. This of itself constitutes a very strong argument against these meretricious appliances to a pure and, simple art; and putting aside, for the moment, the art-question, it is difficult to conceive how the modern Polychromist, if he be a true, conscientious artist, can escape from the dilemma.

DISCUSSION.

The CHAIRMAN said, from the attention with which they had listened to the reading of the paper, he fairly concluded their full and sincere approbation of it, and their gratitude to Mr. Westmacott for having brought this subject before them. He would be glad to hear any observations upon what they had heard.

Mr. JOHN BELL felt some diffidence in taking the initiative, and the only excuse he had for rising was that he was a sculptor as well as Professor Westmacott, and he was glad to be able to say that he entirely agreed with the observations that had been submitted to them; and he was sure all present, not only members of the profession, but all lovers of sculpture, must feel infinitely obliged to Mr. Westmacott for having placed the subject before them in so very lucid a manner. With respect to ancient art, there appeared but little foundation for supposing that the best statues were painted, and there was one remarkable instance to which Mr. Westmacott had not alluded, namely, the celebrated statue of Venus of Cnidos, by Praxiteles. He believed that was considered the most celebrated statue of ancient times. The inhabitants of the Island of Cos gave an order to Praxiteles to execute a statue of Venus. Being determined to please them, he executed two statues—one being draped, and the other not. He gave the people their choice between the two; and they selected the draped figure. The inhabitants of the neighbouring island of Cnidos took the statue which the others had not chosen, and this one became the most celebrated of the two. It was not only "the cynosure of neighbouring eyes," but people came from all parts of the world to see it. The islanders built a temple for it, open on all sides. The people of Cnidos owed a very large sum by way of tribute to Nicomedes, king of Bithynia, who was so enchanted with this statue, and wished so much to possess it, that he offered to remit the whole amount of their debt to him if they would let him have it. They, however, loved their statue so much that they preferred to keep it and pay the tribute. In every way this was regarded as the most celebrated statue of antiquity, and it appeared that it was not painted. It was executed in Parian marble. Pliny had given an account of it; but said not one word about its being coloured; both he and Lucian spoke of the charming expression of the eyes, their swimming-like character, but not a word about colouring. Mention was made of the hair, but nothing about colouring; all of which led to the conclusion that the celebrated work to which he was referring was not painted. This was surely strong negative evidence against this treatment of the statue, but there was stronger evidence than this, and that of a positive character. Lucian also spoke of the extreme beauty of the marble from which it was executed, and said moreover that on one thigh there was a stain in the marble; but, he added, that it even improved the beauty of the rest. It might be very well in those days, with a work so cherished, to fancy that an imperfection in one part could be a foil to the rest of the statue, but that would hardly be the feeling of the sculptor. Their own endeavours as artists were always to get the very best marble they could, and if a dark stain occurred they were excessively annoyed and vexed at it, and would do all in their power to do away with it. Therefore there could be very little doubt that, if Praxiteles had really been in the habit of having his statutes coloured by his friend Nicias, when that stain came out, the first thing he would have done would have been to ask him to paint it over. Therefore he considered that there was not only negative, but positive evidence that the best ancient works in sculpture were not painted; the statue to which he had alluded being considered the most celebrated of ancient times. He would not allude to any other point, as, doubtless, others present were ready to take part in the discussion. In conclusion he begged to say how much he admired Mr. Westmacott's most interesting paper.

Mr. R. J. LANE would relate a brief story in connection with this subject. An Eastern Sultan, hearing of the existence of a very beautiful human figure, executed by a distinguished artist, sent for the figure and the artist together. After due admiration had been bestowed upon this wonderful imitation of the human form, the artist was desired to put a soul into it. Upon this being communicated to him, he with all humility expressed his inability to do so. The result was an order to cut off his head, which was carried into execution.

Mr. BELL said he should have added that the statue of Venus, by Praxiteles, of which he had been speaking, no longer existed.

The CHAIRMAN would venture to offer one or two observations, more particularly with regard to the discovery of fragments of painted sculpture, to which allusion had been made by Mr. Westmacott. He apprehended the case to be this—that all the more beautiful sculptures of Greece and Asia Minor were plundered and carried off by the Romans, and that what was discovered now was found amongst the ruins of buildings, and consisted of fragments of sculpture which, as Mr. Westmacott said, formed a part of the architecture itself, and partook of the character of architectural sculpture. The fact of these being coloured was no argument that statues were painted which did not form part of the architectural decorations. He was glad that Mr. Bell (than whom no better authority existed) had directed attention to that which was a strong argument, viz., that throughout the whole of the works of Lucian, who was an excellent authority upon ancient sculpture, they found no allusion whatever to the colouring of statues. There was a passage in Plato which was the stronghold of Mr. Westmacott's antagonists, but which he had taken no notice of. He (the chairman) had considered that passage, and he did not think it meant anything more than to assert that there were certain persons in Athens whose business it was to paint statues. That there should have been persons employed to paint statues was perfectly consistent with what Mr. Westmacott had said, because they all acknowledged that statues, when they formed part of the architecture of a house, were painted. He would add one other observation on this point. There was a very poetic passage in the works of Eschylus, in which he compared Iphigenia, when about to be sacrificed, to a statue; but there was a peculiar expression to which it was difficult to give force in translation, but which, in fact, implied the want of "speculation" in the eyes, and therefore it must be inferred that the statue was not painted. The passage in the original was as follows:—

*ὀμμάτων δ' ἐν ἀχηνίαις ἔρρει πᾶσ' 'Αφροδίτα.**

Professor Donaldson said after the strong opinions that had been expressed by sculptors, it might appear presumptuous on the part of an architect to offer opinions which seemed antagonistic to those of Professor Westmacott upon this subject. He and Mr. Westmacott were fellow students at Rome; they lived in the same house, and almost pursued the same studies, and Mr. Westmacott would no doubt pardon him if he had arrived at conclusions different to his; but as his reasoning was founded on other authorities, perhaps he might be in error and Mr. Westmacott correct. The Professor began by saying that the painting of statues was an innovation upon the rules of the art of sculpture. He (Professor Donaldson) did not understand what constituted a rule in art, for the mere practice of those who had gone before could not be considered sufficient to constitute fixed rules of art. If a certain practice prevailed among those best capable of understanding the subject, no doubt a rule might be derived from such practice; but, as they lived in an age of progress, and as year by year they were improving upon the practice of those who had gone before them, and new rules of art were introduced, he did not think that an innovation upon the old rules ought to be stigmatised as irregular or improper, but should rather be regarded as opening out new sources of enjoyment to those who loved art and its productions. It was said that sculpture was an art dealing with form only. He did not understand why sculpture should be limited to that, because, it appeared to him, if there were other accessories which gave force, and power, and expression to the productions of the sculptor, there was no reason why he should not avail himself of those accessories to give full development to his work. Let anyone go into the chapel of St. Stephen, where they found the statues of our greatest worthies represented in pure white marble. They were kept as clean and white as washing could make them. What did they represent? To him, beautiful as they were in composition and in execution, they failed to afford a vivid representation of the men of former times, to whose services the country was indebted; they seemed to him mere dead objects—inanimate corpses; because they were merely white, and even the little expression they would acquire by the accumulation of a little dirt upon them was not permitted. They had the appearance of a number of ghosts peopling that vestibule. There could be no doubt that a statue, if mellowed by age, had more charm in it than when it came fresh from the sculptor's studio. It was then white, cold, and repulsive, but time gave it a certain degree of warmth, which was, in fact, colour, and therefore he felt that a sculptor producing a fine work of art in white marble, was producing an inanimate corpse—a dead and repulsive object as to the subject and the material; whereas, if he gave it some colouring, some animation by means of colour, it would address itself more effectually to the imagination. It was stated that because colouring in deep red had been found amongst ancient sculpture, that therefore vermillion was used invariably in this coarse manner. That did not necessarily follow, because where painting was applied, it was only reasonable to suppose that it was employed with a due regard to discretion and the tone of the work to be embellished. It was not to be supposed that these artists would go beyond what they found in nature itself, where all was so harmonious and beautiful. Let them go to the Greeks, who, it was admitted, painted their sculpture under certain conditions connected with architecture. It would be acknowledged that they were a people of the highest sensibilities. The professor had used the term sensuous, which was quite proper, as not meaning to imply the sensual and animal, but rather rising to the intellectual, and these refined people were not insensible of the improvement which sculpture admitted of by a certain degree of colouring. Then, again, look at the Greeks in their poetry. The chairman knew that in their poetry they were sensibly alive to all the delicacies of the measure of their words, their metres, and every other elegance which gave it power and beauty. Then look at their music. They carried the gradations of tone to a much greater degree than we possessed in modern music. In their architecture, too, they did not admit a straight line, both horizontal and vertical lines being slightly curved. If, therefore, in their poetry, in their music, and in their architecture they were thus guided by the highest sentiments of the beautiful, might we not also assume that if they painted their statues they did it with good reason, and not with the idea of merely captivating the senses of the beholder, but rather to satisfy those who required the highest development of art. Professor Westmacott had alluded to the descriptions of sculpture given by old writers, but it should be borne in mind that these writers described the impression upon their minds of what the works were, rather than the actual works themselves. Mention was made of a sculptor who produced a very fine work in bronze, and it was added that iron was mixed with the bronze to produce a certain effect upon the complexion. They must recollect that in the description quoted they had the words of Pliny and not the words of the artist. He (Professor Donaldson) did not possess sufficient chemical or metallurgical knowledge to be able to say whether the effect would be as stated, but oxyde of iron might have been introduced with the bronze to give a richer tone to it, and so far the artist might have been right in giving it what was now called a Florentine tone. All that Pliny could know of the matter was that there was a certain sentiment or expression about the work which had been conveyed to his own mind, whilst the artist himself might only have intended to impart a more beautiful tone to the metal. They might study the annals of every age up to the most recent times, and they would find that always and in all countries there had been a feeling in favour of

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* Æsch: Agamem: l. 418.

Polychromy in art. The sculpture of the Egyptians was painted, as was evidenced by the sphynxes, which, though formed of granite, basalt, and other beautiful materials, were covered with a coating of colour to produce a greater impression upon the minds of the beholders. If they went to the Greeks, they found their buildings and architectural statuary coloured with the same object. In every part he had visited, he found evidences that colouring had been employed even upon the most beautiful marble; and here let him remark, that the beauty of the material of which the statue was made was no evidence against the application of colouring. He very much regretted that the attempts of Mr. Owen Jones to illustrate the polychromy of sculpture at the Crystal Palace had failed, which, as stated by Mr. Jones himself, was owing to the plaster of Paris not being susceptible of that lustre of colouring which could be imparted to the marble, and, therefore, he (Mr. Jones) had made up his mind to have a statue executed in marble upon which to try the effect of the colouring, when, instead of the dulness exhibited by the plaster casts, there would be a degree of transparency and brilliancy, which, he believed, would justify the admirers of Polychromy in the views they held. Going to the mediæval period, they found that all the sculpture was painted. There was hardly a statue or group of that period which had not been coloured. Mr. Westmacott might say that was done to satisfy a craving for effect, but surely it was not probable that the greatest artists of the finest periods of art would degrade themselves by pandering to vulgar taste, in order to produce effect by any means whatever. Therefore, when they looked to those great periods of art and found that even the finest sculpture was painted, they were justified in assuming that a painted statue was a legitimate work of art. It was suggested that the painting might have been only partial painting; but that would be impossible. They knew that architectural statues must be painted wholly and altogether; because, if that was not the case, when they considered the high embellishment of the buildings, if a statue had been only partially painted it would destroy that harmony, and tone, and vastness of effect which were required. Therefore he said the advocates of polychromy in sculpture did not go upon a vague idea, but had some valid reasons for advocating the use of colour. It was contended that, inasmuch as they saw wax figures painted, it was a low style of art to attempt to colour sculpture. There was no fair ground for assuming that, because the panderers to vulgar taste had adopted this means of producing an inferior effect, therefore the true artist should not avail himself of the like means to produce a good effect. It was the object of the sculptor to adhere as closely as possible to nature, and to produce those impressions upon the mind which the living object itself would have produced. Why then should the sculptor disregard that colouring which was an essential part of every living object? Why should they disapprove of the expression given by colouring the eyes, the hair, and the garments, and prefer to produce an inanimate representation in a block of white marble? It was not to be assumed that colour should be employed in an exaggerated manner, but with a due regard to legitimate art. He recollected that Mr. Gibson produced a statue of Lady Beauchamp, with which the family were extremely well satisfied, and which was acknowledged to be a fine likeness. Mr. Gibson afterwards procured the permission of the family to colour that statue, and the result was that, whereas it was formerly a representation of the dead corpse of a person still living, the colouring gave animation and expression, in fact, a soul which it did not possess before. He submitted that every means in the power of the artist should be employed to make a statue as nearly as possible to resemble the person whom it was intended to represent, and this, he maintained, was effected by the use of colour.

Mr. J. G. Crace entirely agreed with all that had been said by the last speaker. Those who had given the matter candid consideration would acknowledge that, where it had been carefully and well done, colour allied to form was a vast improvement. He thought they were too much attached to the beauty of the material of which statues were made, and on this account they discountenanced altogether the application of another art by which those statues might be much improved. Professor Westmacott had started with an admission that the art of painting had been applied to sculpture in ancient times, and then went on to argue that there were evidences to show that this had never been done with the best works. He had stated that there were men in Athens celebrated for their talent in painting statues, and immediately afterwards asserted that no statue of any repute had ever been painted. He would ask the gentlemen who had spoken in condemnation of the application of colour to form, whether they had ever seen it applied. He had had opportunities of seeing it applied in mediæval works, and he had never seen an instance in which he had not felt convinced that it was a great improvement. With reference to a remark that had fallen from the chairman, he thought if he reflected upon the observation he had made with regard to the "eyes" it would lead to an opposite conclusion to that which he had drawn. In reference to its application to architecture, they had abundant proofs that colouring was so applied, and yet how few were the examples that could be produced. Upon a statue that had been buried in the ground, it was almost impossible that any colour could remain. As to the mode of application, he contended that it should not be applied to a material such as marble in a way that could destroy its texture, and if this evil were avoided, he maintained that the sister art of painting could be brought to bear upon the improvement of sculpture. As regarded the ornamentation of the Parthenon, he was happy to hear Professor Donaldson state that Mr. Owen Jones attributed the failure of his attempts to reproduce this to the nature of the material alone, which did not admit of the transparency and lustre which would have been the result of the application of colour to marble. The back-ground should have been massive, in order to throw out the forms, and none of those forms should have had a colour put upon them more positive than that of the back-ground. It was to throw out the forms, to give clearness and distinctness to them that colour was introduced, and in the case of the frieze of the Parthenon, by no other means could those forms have been realised without the application of colour. With reference to mediæval works, it was patent to all that not only were they coloured, but vastly improved thereby. He might mention those great statues in the nave of Cologne cathedral, which were the admiration of all who beheld them.

The Chairman then proposed a vote of thanks to Professor Westmacott for his paper. The vote of thanks having been passed,

Professor Westmacott sincerely thanked them for the manner in which his paper had been received. He had not expected that everybody who had listened to him would agree with all he had said; but he was glad to have this opportunity to ventilate the subject. He had been much gratified at hearing the remarks of his old friend Professor Donaldson, but, at the same time, would have preferred hearing him upon his own art; because he had, as yet, heard no argument which had shaken any of his (Mr. Westmacott's) statements. He had considered all the different points upon which those who had spoken had tried to meet him, and he still felt that the grand principle which he had enunciated was the true one. One gentleman had said that he had brought forward the fact that the ancients painted their statues, and then argued that they did not paint them. He never heard so unfair a conclusion drawn from premises. He would let any candid reader of his paper judge whether or not this was a just conclusion. It was not his province on the present occasion to enter into the question of taste—as to whether people should gild or paint their houses, their statues, or even their faces, but he would say he believed if the practice of colouring sculpture prevailed, all the evils he had anticipated would result from that practice. Sculpture was, after all, an art of *form;* it was no use playing with words, they could make it nothing else. It was either form or not form. They, doubtless, all admired the works of the great painters, but when mere daubs appeared upon a marble statue it was an insult to art to call that painting. He thanked them extremely for their flattering attention to his paper. He was was not at all offended by any disagreement with his own views on the subject, for he was sure that discussions like this elicited truth, and that was all he wanted.

The Secretary announced that, on Wednesday next, the 9th inst., a paper by Mr. William Hawes, Member of the Council, "On the Cape Colony, its Products and Resources," would be read. On this evening William Ewart, Esq., M.P., will preside.

THE FIRST ENGLISHMAN WHO EVER SAW A GALVANO-ELECTRIC TELEGRAPH.

Dr. Hamel, of the Imperial Academy of Sciences at St. Petersburg (and the oldest corresponding member of the Society of Arts in London), has communicated to the Academy some results of his researches relative to the first development of galvanic and electro-magnetic telegraphy. Among other interesting facts, he shows that the youngest of Lady Palmerston's three brothers was the very first Englishman who ever saw a galvanic telegraph. It was the Russian Baron Schilling who, at Munich, so long ago as 1816, had invited the Honourable Frederick James Lamb, then British Envoy and Minister Plenipotentiary to the Court of Bavaria, to accompany him to Dr. Samuel Soemmerring, in order that he might see his telegraph, the first ever made to act by a galvanic battery. Schilling having introduced the British Minister to Soemmerring on the 2nd of July of the year mentioned (1816), repeated the visit with him ten days later, the 12th of July, when the telegraph was made to operate before them. Besides the brother of Lady Palmerston and the Russian Baron Schilling, there were on that occasion present also the Countess Banfy, Schilling's sister, and her husband, Count Banfy, from Vienna, then on a visit at Munich. Dr. Hamel proves that the date of Soemmerring's invention is nowhere accurately stated. His first telegraphic apparatus was made between the 9th July and 6th August, 1809. Baron Schilling, who was at that time attached to the Russian mission at Munich, saw it for the first time on the 13th August, 1810, and from that day he became an enthusiastic labourer in the field of electric telegraphy. In the autumn of 1812, he was enabled, by means of a subaqueous conductor, planned by him, in April and May, at Munich, to explode powder mines across the river Neva, near St. Petersburg. Subsequently, he made the very first electro-magnetic telegraph, a copy of which, in 1836, found its way through Bonn and Heidelberg to London. In 1837, there was at St. Petersburg a submarine cable making for him, with which he intended to unite Cronstadt with the capital, through the Finnish Gulf. His death, which took place on the 7th August, prevented the execution of this early submarine telegraph enterprise. Dr. Hamel remarks, that the Honourable F. J. Lamb, afterwards Lord Beauvale, who married in 1841, at Vienna, where he was more than ten years ambassador, the daughter of the Prussian minister there, Count Maltzahn, and who, in 1848, succeeded his elder brother, the second Viscount Melbourne, so well known as having been long Prime Minister of England, and after whom, in 1837, the present capital of the auriferous colony Victoria in Australia, was named, did not live to see the telegraph introduced there. He died on the 29th of January, 1853. About that time two gentlemen from Montreal, in Canada, Mr. Butcher and Mr. McGowan, left for Melbourne, in Australia, to establish from thence electro-telegraphic lines in various directions. The first, to Williamstown, was opened on the 3rd March, 1854, in the presence of the then Lieutenant-Governor Latrobe. Since last November, the capitals of the colonies New South Wales and South Australia (Sydney and Adelaide) are both telegraphically united with Melbourne in Victoria. Ere long the continent of the distant fifth part of the globe (Australia) will, through Bass's Strait, be electro-telegraphically united with Tasmania, by means of a submarine cable lately made at Mr. Henley's factory, at Enderby Wharf, near Greenwich.

ADAMS'S SYSTEM OF PERMANENT WAY.

In the *Journal** for the 12th of November last was an account of this invention. It is interesting to note the progress which has been made in its adoption. The result of the trial on the North London had been conclusive as to experiment, and the further result in the Eastern Counties, on the main Cambridge line, at a spot "where the ballast was run out and without drainage," purposely chosen, has been satisfactory in point of economy, giving a sound, firm, and elastic road. It has now been specified for several new lines in Great Britain; and the engineer of the Bombay and Baroda Railway has specified it for the remaining portions of his line, under the sanction of Lord Stanley and the Indian Council, after a close examination by their own engineering authorities, Sir Proby Cautley and others.

The following is extracted from the reports of the engineer of the Bombay and Baroda line:—

"Longitudinal Sleepers.

"We owe to the enterprise of the authorities of the Eastern Counties and North London Railways the proof that the first class of permanent way can be laid down on longitudinal timber sleepers, of half the width required for cross-sleepers, and of any convenient length, thus bringing the weight of the sleeper within that which any native Indian labourer could carry on his shoulder. Twelve months' experience of this system, under as heavy and trying a traffic as any in England, justifies its adoption in India, where there can be no doubt that it will enable the native timber to furnish all the sleepers that can be required for railways, and thereby diminish the amount of our freights from England to the extent of 161 tons per mile of line in the one article of timber sleepers.

"Nor is this the limit of the advantage which the system would confer. It enables us to dispense entirely with the objectionable cast-iron chairs and their fastenings. It ensures, by the smaller scantling of the timber, a more perfect impregnation with creosote when necessary. It gets rid of the wood keys, which I am informed by undoubted authority are found in practice most inconvenient and perilous from the impossibility of keeping them permanently fastened in their places in the Indian climate. It admits of the process of reversing the double-headed rail when the upper table becomes worn, and this doubles the life of the rail by avoiding the injuries inflicted by the use of the chair. It gives considerably increased strength to resist oblique and horizontal forces. It will give sleepers admitting of being effectually packed with ballast under their entire nominal bearing surface, as contrasted with the old cross-sleepers, which only admit of effectual packing for about two-thirds of their length. It gives the rails an uniform bearing on the sleepers in their entire length, instead of being supported at points with 2 feet 6 inches to 3 feet intervals, and makes a much more easy road as regards the movement of trains.

"Finally, it reduces the cost of construction as compared with the cross-sleeper road, by over £930 per mile, which on our 164 miles between Surat and Bombay, just undertaken for

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* Vol. VI., page 717.

> construction, would produce a gross saving to the Company of about £153,000."

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> "I have now fulfilled my duty in bringing before the Board and the Government the consideration of this important subject. It is for them to decide whether an improved principle of railway construction may be introduced upon our line that shall give us a much better road, with a saving of £930 per mile in the first cost, and a gross saving of £153,000 on the 164 miles between Surat and Bombay—that shall adapt itself to the existing requirements of trade and navigation between Great Britain and India—that shall reduce enormously the cumbrous contingencies attending the enterprise in which we are engaged, and, in the ratio of such reduction, increase the facility and rapidity of its execution,—finally, that shall enable us to complete the above-mentioned 164 miles, with the limited tonnage of 37,000 tons of materials supplied from England, instead of 72,000 tons.
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> "An early decision on the subject is much to be desired, as it will be of great importance to the progress of the works, that the contracts for permanent way for the sanctioned 117 miles between Surat and the Veturnee River should be made with the least possible delay."

In the appendix to Colonel Kennedy's report are letters from Mr. H. Martin, the Engineer-in-Chief of the North London Railway; Mr. Robert Sinclair, the Engineer-in-Chief of the Eastern Counties Railway; and Mr. John T. Burke, the Engineer-in-Chief of the Tenby and Pembroke, and of the Cowes and Newport Railways, stating their favourable experience of the system, and their intention to adopt it on the several lines with which they are connected.

What is good for India is good for our other colonies, and, in fact, for all countries to which the appliances of permanent way are imported, unless to countries where timber is so scarce as to induce pilferers to steal it for the sake of fuel. In such cases it is probable that the substitution of longitudinal angle irons instead of timber, bolted to the rails laterally, may prove the most desirable. It has been ascertained that from nine to ten inches continuous width of bearing under each rail, where the rail is sufficiently deep to prevent mischievous deflection, is ample for very heavy traffic; and, as this only involves the use of 4½ angle iron, instead of the greater widths used in the first trials, the first cost is, in fact, reduced below that of the ordinary cross sleeper road.

BREAD BY MACHINERY.

Machinery for the making of bread has lately been introduced into this country by Mr. Miller, a baker in Upper George-street, Edgware-road, who also adopts some modifications of the usual process of preparing the dough. The machinery comprises a mixing machine, a kneading machine, and a machine for forming the loaves. The mixing machine consists of an iron cylinder, through which a horizontal axis passes, having a series of beaters, or blunt knives, fixed at right angles to it. Each knife or beater is bent round, in the form of an oblong parallelogram, which extends from the axis to within a short distance of the inner surface of the cylinder. The cylinder is stedfast, while the axis carrying the beaters revolves inside. The materials for making the bread are placed inside the cylinder, and in a very short time, by the action of the machine, they are thoroughly mixed. The kneading is performed by passing masses of the mixed material, after it has stood a sufficient time, through a pair of steel rollers several times, and thus it becomes kneaded and thoroughly amalgamated into a uniform dough, suited for passing into the next machine, which forms it into loaves. This machine consists of a sloping platform, which delivers the dough into a pair of steel rollers working horizontally at the end of it, capable of adjustment to any suitable distance. Beneath those rollers revolves an endless web, which, by means of a simple mechanical arrangement is carried step by step the exact space required for the cutter, which stamps out the loaves from the dough in succession, as it is carried along the web in a thin uniform sheet. The pieces of dough thus cut, which are not more than three-quarters of an inch thick, are set side by side on flat tins, and placed in a warm atmosphere for about thirty or forty minutes, until the dough has risen somewhat, when they are put in the oven. The modified process for making the bread is as follows:—

The dough after it has been mixed and kneaded in the usual way for making bread, is kept in fermentation for about six hours or more, until it has reached the acetous state, and become unfit for use in the ordinary process, when there is added to it one-fifth of its weight of dry fresh flour, and without any additional water it is mixed and broken rapidly and very thoroughly through rollers, cut and pierced in a cutting machine, or by other means, and after a slight fermentation in an uncovered state exposed freely to the air, say, for thirty to forty minutes, according to the temperature of the room, to raise it, baked it in a quick oven, which should be ventilated by an open door or other means of admitting and discharging the air freely. In making the dough, about ninety-five pounds of water to two hundred pounds of flour are used, and from this weight there result usually two hundred and eighty-two pounds of baked bread. The invention is applicable in making bread from any kind of flour of which bread may be made, and is said to produce the same beneficial result in the use of all kinds.

The inventors do not confine themselves to the precise details above described, as such may be varified or modified without departing from the principle of action thereof; but they claim as new, the process of allowing the dough to ferment till it passes into the acetous state, then reviving it by working and breaking it into fresh dry unfermented flour, aterwards cutting and piercing it, and raising it while exposed freely to the air, and baking in an open or freely ventilated oven.

The mixing cylinder in use at Mr. Miller's is sufficiently large to take half a sack of flour at a time. The whole of the machinery is driven by a small steam engine of two-horse power.

The machinery and process generally are American inventions, and form the subject of patents in that country as well as in this.

Home Correspondence.

ELECTRO-PLATING ENGRAVED COPPER-PLATES.

Sir,—In a letter upon "Electro-plating engraved copper-plates," inserted in your last number, the author says, "It is a tolerably well-known fact amongst those conversant with electro-metallurgy as applied to printing purposes, that engraved copper-plates have since many years been coated with silver and gold, for the purpose of protecting the plates from wear while being printed." Will Mr. Bradbury state any instances, for the information of those who, like myself, are unacquainted with the fact?

I am, &c.,
GEORGE T. DOO.

Great Stanmore, March 1st, 1859.

Sir,—The considerable amount of copper-plate engraving annually done in this country, renders it a matter of general interest that any new improvement in the means used, tending to obtain good printing in very large numbers, should be fairly brought out before the public, and I thought I had sufficiently fulfilled this duty when I last year introduced the valuable process of "acierage of engraved plates." That some attempts at imitation of the process should already have been made, is not to be wondered at, considering the practical value of the invention; and in a letter from Mr. Henry Bradbury, in your last number, in order to screen himself from imitation, he brings forward a counter-charge against me of having copied others, on the startling assumption that "it is a well-known fact that gold and silver have been for many years used for coating plates to protect them from wear while being printed."

This is contrary to facts, and all the printers with whom I have acquaintance, after being consulted, will bear testimony that Mr. Bradbury is in a complete error; that there was a great desideratum for some means of protecting engraved copper-plates from wearing away as they do while at printing, and that the principal houses in London, Messrs. McQueen, Messrs. Brookes, and others hailed with great satisfaction the introduction of my process.

That other metals, besides gold, silver, iron, and zinc, should be capable also of yielding deposits in a manner so as to render them useful for printing purposes, is nothing new to me, and it is of course open to any one to try them; but I believe that, as I have stated elsewhere, the metal I am using will be found the most desirable, and the most serviceable, as it is doubtless the cheapest and most abundant; and as to cost, the notion, as advanced by Mr. Bradbury, of being able to deposit palladium at two pence and platina at one penny per square inch is simply an hallucination worthy of the assertion by the same person, of being able to print off 2,000 good impressions from a zinc deposit; besides, the extreme difficulty of removing the coating of platina from the surface of an engraved copper-plate would be a serious bar to using that metal with any degree of safety.

Before retiring from this controversy, into which I have been forced, much against my habits and my wish, I shall only briefly say that, being taunted by Mr. Bradbury with what he is pleased to call my acquired process, I readily acknowledge that I have acquired it by the most legitimate and fair means.

I am, &c.,
F. JOUBERT.

Porchester-terrace, March 1st, 1859.

MR. CHESTER'S PAPER ON THE EXAMINATIONS.

SIR,—Deeply interested in the subject of Mr. Chester's valuable paper, read before the Society on the 16th Feb., I listened with great attention to the discussion that followed, and much regretted to find that the time of the meeting had expired before the subject had elicited all the valuable remarks which I feel confident would have followed in a more extended discussion. There were a few remarks of a practical nature I wished to have made, if an opportunity had occurred; and, with your permission, I will now present them in the *Journal.*

I cannot subscribe to the proposition of Sir Thomas Phillips, that, give what chances you may to men in general, there are but very few of them will succeed or ascend in the social scale. This proposition is directly opposed to my own observations; and after many years' close and attentive investigation, I am convinced that, with equal chances, there are but few men who would not succeed equally with the most fortunate; and I firmly believe that there have been many George Stephensons who have passed through life unnoticed and unknown, by which the world has been a very great loser.

I cannot agree with Sir W. Page Wood that Mechanics' Institutions have been failures, although I am fully aware that in many instances they have not accomplished all that was expected from them; neither can I agree with Lord John Russell, that Mechanics' Institutions were introduced twenty years too soon or in advance of the times.

My own convictions on that subject, which are very strong, are the result of having been one of the earliest associates of the late Drs. Birkbeck, Gilchrist, Fellows, the present Lord Brougham, and others, in the inauguration of that important instrument of education, then, for the first time, presented to the mechanics of London, not as a mere speculative theory, but as the result of twenty years' previous successful experience of the Glasgow Mechanics' Institution, which had been founded by Dr. Birkbeck, as he often beautifully, and in his own peculiarly powerful manner, told us, from his observations of the anxious desire of working mechanics to understand the uses and application of the machines they were employed to construct.

That Mechanics' Institutions diffused such useful practical knowledge among the working classes to a very large extent, is a fact that cannot now be ignored, for many living proofs exist in persons who have advanced in social position entirely from the knowledge they gained in the classes of the Mechanics' Institutions; and therefore, had society waited twenty years longer for such a step in the path of education, it is not at all clear how it would have been better able to apply and appreciate such advantages.

Mechanics' and other analogous Institutions have not failed in their objects, which have been substantially realised. They may not have succeeded to the extent hoped or expected from them, but such shortcomings must be looked for from other influences, and may, I submit, be found among those commercial calculations of success that would estimate the sum that would induce a man to throw himself into a river or suspend himself from a tree, or, which is about as consistent, tempt him to immure himself in the bowels of a mine or the intestines of a sewer, for all the waking hours of his natural life. The fact is that Mechanics' Institutions have been eminently successful in the spread of useful practical knowledge, but they have not been made self-supporting, and, consequently, they have from time to time been drawn out of their proper course by the variations in feelings and opinions of those upon whom they have been dependent for support. The progress of such institutions has also been much influenced by the altered circumstances and locations of their members, very many of whom have been compelled to remove their homes beyond the influence of such institutions.

There is one remark of Lord John Russell's that I am sorry to say my own observation obliges me to confirm to some extent, but I do know many exceptions; that the highly-paid, skilled workman frequently abuses the advantage of his position, but in such cases I think it will be found, upon investigation, that such persons have not received any part of their education in Mechanics' Institutions.

That the means of general useful education exist already to a greater extent than is accepted by those most interested in such acquirements is much to be regretted; but we must not jump to the conclusion that because greater numbers do not avail themselves of the means within their reach that they are indifferent or culpably neglectful. In reference to the means of education, I think I may with confidence refer to the operation of our own parochial schools, and without comment take my parish (Clerkenwell), and say that the always requiring in my business one or more boys from the age of about thirteen to fifteen, has, in the course of many years, given me a large experience, and it has been with me a general custom to take such boys from one or other of the schools in the parish, without regard to sect; and now, after the practice of many years, I have much pleasure in stating that from such sources I never had one bad boy; all that I can trace have done well; some have remained in my own establishment twenty or thirty years, in the discharge of duties requiring the strictest integrity, as they are wholly employed in working the precious metals. Others have sought and found most successfully a still higher position; and among such there at the moment occurs to me the career of three of them, one of whom is now at the head of a very old and highly respectable wholesale firm in London; another is holding and discharging with the highest satisfaction an important public situation in Hong-Kong; and the third is now on his passage home to his native country, a retiring South-American merchant, having realised an ample fortune.

This view of the subject is pleasing to contemplate, but it unfortunately has its reverse, which, although painful, is no less important to investigate, and I have gained some insight into the operation of such melancholy causes and effects, by lately requiring a boy when there were not any in our schools ready for employment—in consequence of which I made my want public and in a very short time I had fourteen applications from boys, some of them appearing sharp, intelligent lads; but, to my great surprise, I found that in the fourteen there were eleven who could not read or write—a fact which led me to investigate the cause of such lamentable ignorance; and, although the reports of so many cases would be long and monotonous, I may briefly sum them up by stating that I found eight out of the eleven were the sons of widows who were left with families of three to seven children, without any means for their support but what they could obtain from the premature labours of their children, who, consequently, could not be spared for the advantages of the school, otherwise within their reach, while their parents all appeared most anxious for the welfare of their children. Here is a difficulty in the path of philanthropic exertion to ameliorate the condition and prospects of a large number of the working-classes in the community, which it appears to me cannot be overcome without providing for those so necessitated the means of useful remunerative employment, so that they may be enabled out of their own industry to emancipate themselves not only from the evils of general poverty, but from those that press with the greater weight, because they too frequently burst suddenly on comparative prosperity, from some one or other of the numerous sources of affliction from which very few families are wholly exempt. This view I know involves the discussion of another question, but it is no less a very serious difficulty in the way of the great education question, taken up with so much zeal and perseverance by the Society of Arts.

I am, &c.,
E. NASH.

30, Coppice-row, Clerkenwell, 19th Feb., 1859.

BOOKS AND LIBRARIES.

Sir,—Permit me to offer a few remarks in connection with Mr. Leighton's interesting paper on Books and Libraries.

On the subject of the changes which occur in paper by age, and the destruction of books by insects, it would be extremely desirable to have a more accurate investigation of the various effects supposed to originate in damp, and the best modes of preventing the pernicious results; and I would venture to suggest that some of your members and correspondents residing in India and other warm climates could furnish valuable assistance in this respect, by examining into and reporting upon the condition of printed books and written documents, both paper and parchment, parchments which may have been deposited for a lengthened period in those hot regions.

The inquiry should be conducted with special reference to the two-fold method of sizing paper—the gelatine or English mode, and the vegetable or continental system. Which suffers most, and whether in the same form, by mildew or insects? May not the circumstance of the Chinese paper being generally sized with a solution of starch, account in some measure for the paper being a ready prey to insects, as stated by Mr. Leighton? Is it the fibre of the paper or the size which is the primary attraction, and the cause of the deplorable ravages of these hosts of tiny enemies?

I believe the only provision hitherto made against decay (decomposition of the size) and insect attack in warm climates is to well alum the size; I may observe, however, as bearing on this point, that the late Professor Cowper informed me that by adding a little corrosive sublimate to the paper pulp which he occasionally used in the illustration of some of his lectures, he effectually preserved it from "mothering" for an indefinite period.

An illustrated edition of Campbell's poems in my possession is quite spoiled, as if by iron-mould, but the spots appear to result from the development of fungi rather than from the presence of any metallic substance. Almost every spot has its echo on the opposite page, so that it is difficult to say which originated the other. The spawn appears to have found suitable nutriment in the sizing matter of the opposite page in contact, and so spread until, by some accidental change to a drier situation, the growth was stopped. Has any observer carefully noted spots of this description under a microscope?

The improvements of science have their accompanying disadvantages. Gas itself, the creation of modern chemistry, is the greatest enemy of our books in large towns; and it must also undoubtedly be admitted that some of the chemical preparations employed to impart to paper the brilliant purity of colour so much demanded by the trade and the public, are of only temporary value; and, being themselves affected by the slow action of the atmosphere, leave the paper of an unexpected and undesirable sallow hue.

Few things are more disagreeable to a careful reader than a torn map or illustration in a book; this disfigurement may be obviated by the illustration or map being so arranged as to occupy the space of two pages, being mounted by the central divisional line on a guard in binding, thus opening and shutting as a double page when referred to, and never projecting beyond the other leaves of the book. This is much better than placing maps in pockets. It is always objected to by printers and binders on account of the extra trouble, but a little quiet persistence generally induces a change of opinion, and the "cannot be done" of yesterday becomes the "much better" plan of to-day. In the Society of Arts' library instances of the success of this system are not wanting; and it is seldom that book illustrations or maps require to exceed the space of two pages of the letter-press.

In a private library, glass-cases, and even curtains are an abomination to an earnest reader. Books are for use, and the more easily accessible the better for those who have little time; open shelves, with leather falls, a shelf being devoted to each subject, are to my mind the best compromise between utility and preservation, and the simplest mode of arrangement; and, inasmuch as, in addition to the necessary variety of dimensions of books, the tastes of authors and publishers preclude our arranging the volumes on each subject in regiments and in the uniforms suggested by Mr. Leighton, "Green for Botany, &c.," some degree of uniformity in variety may nevertheless be obtained by placing all the books on any one subject upon its allotted shelf; first, according to their size, thus gratifying our idea of order, and next according to the colours of the binding, keeping the greens together, and so on; even the various tints may be arranged so as to be grateful to the eye.

A small amount of trouble in this matter will frequently make a great change for the better in the aspect of even a small library.

For books purchased one by one, and well studied, an affection springs up which subsequent change in the binding can only impair; the very diversity of the bindings gives a pleasant individuality to books; and the "whole" binding of a book to which we have been previously accustomed in a less perfect form, is often like elevating an active commoner to the peerage—our friend becomes silent, the sympathy is diminished.

A word or two on margins:—I would not follow the example of Mr. Leighton's friend, and cut down all the margins to the print, nor do I approve of excessive underlinings, such as those of an old Scotch friend of mine, who, to intensify the effect of a letter he had written, began by underlining the whole with black ink lines, then added a few extra dashes under important words; a further supply of lines in red ink increased his emphasis, and, to crown the whole, one or two words were favoured with a fourth underlining.

If we agree with our author, no long expression of approval is necessary; and if we disagree, there is seldom room in the margin to argue the point at full length.

Further, at the time of reading we may not have a convenient opportunity for jotting down observations; we may be in a coach, or in a railway train, or walking, or the ship may be pitching heavily. Moreover it interferes with the course of the reading; and, if accomplished, on opening the book at a subsequent period the notes may not be at hand. The following is a simple plan of making notes, which remain ever and always present when the book is opened, recalling the points which most attracted attention when the volume was the subject of study. A small circle in the margin denotes a great thought or a happy expression, deserving to be remembered quite apart from the particular subject of the work; a square indicates a clear statement of the author's views; a triangle shows that on the lines opposite the mark will be found some knotty point not understood, or some statement upon which the reader differs in opinion, or a matter requiring investigation.

By these simple indications, requiring only the possession of a pencil, we converse with our author, and admire, approve, or dissent, as the case may be, without interrupting the course of our reading; and when the volume is finished, these points may be scheduled, and notes and extracts made at leisure; and, on turning over a book in after years, the impressions of its first reading are revived, and the character of its contents brought back to the memory.

I had hoped to have heard from Mr. Leighton some useful suggestions with respect to the library of the Society, and, not to prolong this already lengthy letter, would merely throw out a few hints on this subject.

The library is hardly *au courant* to the Society's other operations, and cannot be considered a model. I believe it is innocent of a correct catalogue. The books are much crowded, and the cases dispersed throughout the building. No part of the Society's funds is appropriated to the purchase of new works; and I presume the library is only enriched by donations or exchange of "Transactions" with other Societies.

The Society's operations are now so multifarious that this important matter seems almost entirely overlooked. Although the Society possesses many valuable works, they are but little available for study, on account of the want of space and accommodation.

The British Museum being so near, perhaps it may be thought unnecessary to devote much attention to our library as one of reference. Would it not, therefore, be advisable, in order to increase its usefulness, to organize a system of circulation, as has been done in the case of the library of the Corporation of the City of London, which is now conducted in the following manner:—

The books are divided into two classes.

1st. Modern, and such as can be easily replaced.—These are allowed to be circulated amongst the members of the Common Council and readers introduced by them.

2nd. Scarce Works.—These are not permitted to be removed from the library, but are always readily accessible on application to the courteous librarian.

Hoping that among these desultory thoughts may be found the germs of suggestive matter to some of your readers, I am, &c.,

W. STONES.

PRODUCTS OF THE COMBUSTION OF COAL-GAS.

Sir,—In the discussion of Mr. Leighton's paper at the Society of Arts, on Wednesday last, a letter was read from Dr. Letheby, alleging that the bindings of books, &c., were destroyed by the action of oil of vitriol produced during the combustion of coal-gas.

In consequence of Dr. Letheby having made a similar statement to the Commissioners of Sewers of London, in the year 1854, the directors of the Chartered Gas Company applied to Dr. Leeson and Mr. Warrington for their opinion, and the following extracts from their report will show that the fears entertained by Dr. Letheby are without foundation.

After expressing their regret that Dr. Letheby has not given the details and *modus operandi* of the experiments he made, they go on to say that "Without for one moment doubting the intentional accuracy of Dr. Letheby's statements," they believe that the oil of vitriol "has been *manufactured* from the gas; not produced by the ordinary method of combustion, but by a peculiar process adopted for these experiments;" and they "have reason to doubt, in the absence of any specific evidence to the contrary, whether all the acid produced was actually sulphuric acid." Their report proceeds as follows:—

"To show the actual contamination of the air of an apartment in which gas is burnt, the air itself ought to be analysed, and we should then probably find that any sulphuric acid generated by the ordinary combustion of the gas has been neutralised by the ammonia frequently contained in it, by the lime or carbonate of lime present in the whitewash or plaster of the ceilings and walls of an apartment, as well as by other combinations. The absence of any such experiment removes from a reflecting mind confidence in these deductions; and then supposing, which is difficult, that free sulphuric acid[*] (oil of vitriol), which requires a temperature approaching a red heat (620° of Fahrenheit), or rather above the melting point of lead, to sustain it in the vaporous condition, could exist in the atmosphere of an apartment. If its per centage in the air had been shown by experiment, the public would probably have smiled at its infinitesimal proportion, instead of being alarmed at the fearful amount of 15 grains of *oil of vitriol* from every 100 cubic feet of gas.

* * * * * *

"Again, we are told that these conclusions are borne out by experiments made at the Athenæum and elsewhere years ago, by chemists whose accuracy and talent we would not for a moment question; but it must be remembered that these experiments were made at a period when the methods of purifying gas were far less efficient than those at present employed, and the results simply show, what can be well imagined, that the atmosphere of rooms, constructed without any ventilation, like an inverted bell-glass, to receive and contain not only the various products from the combustion of either candles or numerous gas-burners, but also the exhalations, dust, and heat of a crowded apartment, was certain to prove injurious to a material like the leather used for binding books, which, from its peculiar constitution, is very subject to decay, and when exposed to a heated and vitiated air soon becomes friable and rotten; this decay has been observed in many old libraries long before the use of gas was known.

"As to the amount of sulphur actually existing in combination with the gas from which this "oil of vitriol" has been manufactured, it is manifest that the experiments have been far too limited in number to determine anything like an accurate average of the sulphur contained in the various gases consumed in this metropolis, and we have reason to believe that the experiments referred to were made at a period when, from an unprecedented combination of circumstances, the gas companies were obliged, for a short period, to resort to an inferior description of coal, containing much sulphuret of iron, the gas from which required a larger amount of purifying power than had been provided for this unforeseen emergency. This want was speedily remedied, and there is but little chance of the recurrence of any similar disaster."

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[*] **When in the concentrated form, which renders Dr. Letheby's statements so fearfully appalling.**

The report goes on to argue that if so large a quantity of vitriolic acid is produced in the combustion of coal-gas, the amount which passes into the atmosphere from the coal used in the ordinary fires in London must be so enormous as to be seriously injurious to health. The rate of mortality, however, they argue, proves that this cannot be the case. The report proceeds as follows:—

"Here, then, it may be well to consider whether part of this improved condition as to health be not attributable in some degree to the action of the sulphurous acid, not 'oil of vitriol,' which is continually passing off from our coal fires, uniting with and destroying many of the fœtid animal and ammoniacal exhalations from the crowded poor and the sweating labourer? It is even admitted in this report [by Dr. Letheby], after having created sufficient alarm by the terms 'oil of vitriol' and 'vitriolic acid,' that a '*large portion* of this dangerous compound would doubtless be NEUTRALIZED by the AMMONIA of the gas and by that of DECOMPOSING ANIMAL SUBSTANCES. If a *large portion* of the minute quantity of sulphur-compounds at times contained in coal gas are admitted thus to unite with these *really poisonous exhalations*, and thus neutralise their baneful effects, it is but rational to conclude that the sulphurous acid, whether from our coal fires or our gas, is performing an important function in disinfecting the atmosphere of this densely crowded city of much of its poisonous and putrescent miasm.

"But is this *large portion*, which is thus admitted to *unite* and *be neutralized*, estimated, and deducted in the report from the whole quantity? On the contrary, Dr. Letheby's report proceeds thus:—'Much would remain in a free state, and *be the source of incalculable mischief*:' how or in what way this *incalculable* mischief is to arise, we are not informed."

I beg also to call your attention to a report made by Dr. Faraday, some years since, to the Committee of the Athenæum Club, of which the following is an extract:—

"*Question.*—Is either sulphurous or sulphuric acid formed by the combustion of coal-gas in the ordinary way? *Answer.*—A little sulphurous or sulphuric acid is generally formed from the combustion of coal-gas. If well purified gas be used, this product is *rarely sensible*; it is less sensible as sulphuric than as sulphurous acid thrown into the room. I think little of it."

The following extract from a paper by Mr. Lewis Thompson, on this subject, is very conclusive:—

"No mortal man ever did or ever can obtain 21 grains of oil of vitriol from (I will not say 100 cubic feet of gas, but) from the combustion of 100,000 cubic feet of any coal-gas supplied to the public within 20 miles of St. Paul's Cathedral. The substance really obtained is not oil of vitriol at all, but sulphate of ammonia, and upon this I most unhesitatingly pledge my character as a chemist. Oil of vitriol is a highly corrosive liquid, whereas sulphate of ammonia is a harmless solid."

I could quote also the opinions of other eminent chemists who distinctly state the impossibility of forming oil of vitriol during the combustion of coal-gas in the ordinary way; but I trust I have shown sufficient evidence to allay any alarm that may have been produced by the reading of Dr. Letheby's letter.

I am, &c.,
F. J. EVANS.

Gas Works, Horseferry-road,
March 2nd, 1859.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
London Inst., 7. Rev. Henry Christmas, "On Shakspeare's Historical Dramas."
Medical, 7. Anniversary Election.
Entomological, 8.
British Architects, 8.
United Service Inst., 8½. Capt. Fishbourne, R.N., "On the Effect of the Introduction of Rifled Cannon on Naval Architecture."

Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Medical, 5. Anniversary Oration.
Syro-Egyptian, 7½. Rev. Dr. Hewlett, "On the Geology of the Valley of the Nile."
Civil Engineers, 8. Discussion on Mr. Mallet's Paper on the Co-efficients of Elasticity and Rupture in Wrought Iron;" and, if time permits, Mr. T. F. Chappi, "An Account of Experiments upon Elliptical Cast Iron Arches."
Medical and Chirurg., 8.
Zoological, 9.

Wed. ......Literary Fund, 2. Anniversary.
United Service Inst., 3. Rev. W. Ellis, "On Madagascar and its Inhabitants."
London Inst., 3. Mr. E. W. Brayley, "On Meteorology."
Society of Arts, 8. Mr. William Hawes, "On the Cape Colony, its Products and Resources."
Geological, 8. I. Mr. J. Y. Tayler, "On the Veins of Tin Ore at Evigtok, Greenland." II. The Hon. C. A. Murray, "On some Minerals from near Tabriz, Persia." III. Mr. J. W. Kirkley, "On the Permian Chitonidæ of Durham."
Graphic, 8.
Archæological Assoc., 8½.

Thurs. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Royal Soc. Club, 6.
London Inst., 7. Prof. Bentley, "On Vegetable Substances used for the Food of Man."
Antiquaries, 8.
Philological, 8.
Royal, 8½.

Fri. ....United Service Inst., 3. Admiral Fitzroy, "On Meteorology."
Astronomical, 8.
Royal Inst., 8. Meeting, 9. Dr. W. Odling, "On Magnesium, Calcium, Lithium, and their Congeners."

Sat. ......London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

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SESSIONAL PRINTED PAPERS.

Par. No.

Delivered during the Vacation 1858.

500. Magistrates' Clerks Fees—Return.
68 (xi). Trade and Navigation Accounts (30th Nov. 1858).
98 (A h). Poor Rates and Pauperism—Return (A).
461 (i). Colonization and Settlement (India)—Index to the Four Reports.
455. Public Income and Expenditure (1856-7 and 1857-8)—Return.
98 (A xi). Poor Rates and Pauperism—Return (A).
230. Poor Relief—Returns.
248. Bill—Equitable Councils of Conciliation.
Army (Promotion and Retirement in the Higher Ranks)—Report of Commissioners.
Births, Deaths, and Marriages in England—19th Report of the Registrar-General.
Statistical Tables relating to Foreign Countries—Part 5.
East Indies (Mutinies)—Further Papers (No. 8).
Manufactures and Commerce—Reports of Her Majesty's Secretaries of Embassy and Legation.
Trade and Navigation (1857)—Annual Statement.
East Indies (Mutinies)—Further Papers (No. 8a).
Colonial and other Possessions—Statistical Tables, Part 3.
Public General Acts—Cap. 21—110, and Table.

Delivered on 4th February, 1859.

Guano—Correspondence with the Agents of the Peruvian Government.

Delivered on 5th and 7th February, 1859.

2. Property and Income Tax—Amended Return.
3. Property Tax and Population.

4. Bill—Occasional Forms of Prayer—
Russia (Commerce and Navigation)—Treaty.
Brazil (Settlement of Outstanding Claims)—Convention.
Moldavia and Wallachia (Organization of Principalities)—Convention.

Delivered on 8th February, 1859.

25. Metropolitan Improvements—Statement of Advances out of the Consolidated Fund.
20. Metropolitan Main Drainage—Copy of Letter.

Delivered on 9th February, 1859.

1. Public Income and Expenditure (Balance Sheet)—Account.
83. General Committee of Elections—Mr. Speaker's Warrant.

Delivered on 10th February, 1859.

9. Registration of Voters (Scotland)—Return.
21. Tax Collectors—Return.
30. Navy (Pensions)—Return.
35. East India (Loan)—Returns.
East Indies (Mutinies)—Further Papers, No. 9.

Delivered on 11th February, 1859.

6. Railway and Canal Bills—Report from the Board of Trade.
34. East India (Revenues)—Return.
2. Bills—Superannuations.
4. ,, Highways.
10. ,, Endowed Schools.
11. ,, Sale of Poisons.
13. ,, Church Rates Abolition.
14. ,, Church Rates Commutation.

Delivered on 12th and 14th February, 1859.

8. Roads (Scotland)—Return.
12. Poor Relief—Returns.
14. Superintendent Registrars—Return.
29. Episcopal and Capitular Property (Metropolis)—Return.
37. Bank of England—Annual Accounts.
38. ,, ,, Copy of Applications for Advances to Government.
22. Naval Receipt and Expenditure—Account.
43. Navy (Excess of Expenditure for the year 1857-8)—Statement.
44. Post Office Department (Packet Service)—Estimate.
42. Navy—Estimates.
9. Bills—Tramways (Ireland).
15. ,, Elections, &c.
16. ,, Municipal Election.
Tariffe—Return.
Commissariat Department—Royal Warrant and Report of the Committee.

Delivered on 15th February, 1859.

7. Houses, &c. (Boroughs)—Return.
8. Ecclesiastical Commission (Ireland)—Annual Report.
49. Treasury Appointments—Copy of Treasury Minute.
32. Oxford University (Pembroke College)—Copy of an Ordinance
39. East India (Civil Service)—Regulations.
3. Bills—Manor Courts (Ireland).
5. ,, Markets (Ireland).
7. ,, Lunatic Poor (Ireland).
18. ,, Ecclesiastical Commission.

Delivered on 16th February, 1859.

40. East India (India Office)—Copy of an Order in Council.
45. Colonels—Supplemental Return.
46. Army—Copy of General Circular.
8. Bills—Receivers in Chancery (Ireland)—Abolition, &c.
12. ,, Marriage Law Amendment.
19. ,, Title to Landed Estates.
20. ,, Registry of Landed Estates.
16. College of Advocates (Doctors' Commons)—Return.
24. Session Clerks—Return.
28. Hocquard *v.* The Queen, ship "Newport"—Return.
36. Divine Service (Army)—Return.
55. East India (Finance)—Copy of Despatch, &c.
66. ,, ,, (Loan)—Subscriptions.

Delivered on 18th February, 1859.

63. Army Estimates.
50. Local Acts (1, Falmouth Docks and Harbour—2, Fishguard Harbour Improvement—3, Kirkwall Harbour—4, Cork Harbour Reclamation—5, Dartmouth and Torbay Railway—6, Findhorn Railway—7, Formantine and Buchan Railway—8, Hereford and Brecon Railway—9, Holyhead and Bangor Railway—10, Belfast and Londonderry Junction Railway—11, Cleveland Railway—12, Waveney Valley Railway—13, Chichester Harbour Embankment—14, Portsmouth New Docks and Railway)—Admiralty Reports.
6. Bills—Sale and Transfer of Land (Ireland).

Delivered on 19th and 21st February, 1859.

31. Queen Anne's Bounty—Account.
34. East India (Finances)—Copy of Dispatch and Review of Finances
57. ,, ,, (Transport of Troops, &c.)—Returns.
58. Public Income and Expenditure (31 March, 1858, to 31 December, 1858)—Return.
66. Shipping—Return.
67. Post Office (Compulsory Prepayment)—Return.
68. Trade and Navigation Accounts (31 December, 1858).
20. Stage Carriages, &c.—Returns.
59. Mint—Account.
65. Navy—Returns.
17. Bills—County Prisons (Ireland).
21. ,, Piers and Harbours.
23. ,, Real Estate Intestacy.
25. ,, Juries (Ireland).
26. ,, Edinburgh, &c. (Annuity Tax).
28. ,, Medical Act (1858) Amendment.
29. ,, Lunatics (Care and Treatment).
30. ,, Lunatic Asylum, &c.
31. ,, Burial Places.
32. ,, Sale of Grain, &c.
Guano—Correspondence.

Delivered on 22nd February, 1859.

5. Duchy of Cornwall—Account.
10. Burial Grounds (Metropolis)—Returns.
13. Sanitary Improvements (Metropolis)—Returns.
41. Flogging (Navy)—Return.
52. Bankrupts' Certificates—Return.

Delivered on 23rd February, 1859.

23. Woods, Forests, and Land Revenues—Abstract Accounts.
69. East India—Extracts from Financial Letters.
70. ,, ,, (Home Treasury)—Estimates of Receipts and Disbursments.
76. Greek Loan—Account.
77. Public Debt—Account.
78. Russian Dutch Loan—Account.
79. Sardinian Loan—Account.
80. Harbour, &c., Bills (Wear Navigation and Sunderland Docks, and Sunderland Dock Capital)—Board of Trade Report.
27. Bills—Newspapers, &c.
34. ,, Inclosure.
35. ,, Local Assessments, Exempton Abolition.
36. ,, Poor Law Boards (Payment of Debts).
Manning the Navy—Report of the Commissioners.

Delivered on 24th February, 1859.

15. False Weights and Measures—Return.
71. Army Commissions—Return.
75. Bullion—Return.
24. Bill—Registration of County Voters (Scotland).

Delivered on 25th February, 1859.

48. Metropolitan Police—Accounts.
64. Customs Department (Port of London)—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, February* 25, 1859.]

Dated 19th October, 1858.

2328. E. Walker, London-street—An improved filter. (A com.)

Dated 27th December, 1858.

2960. J. Davies, Liverpool—An improved portable selfgas generating lamp. (A com.)

Dated 14th January, 1859.

123. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—A new or improved time-measurer. (A com.)

Dated 19th January, 1859.

158. J. Thornton, Cleckheaton, Yorkshire—Imp. in carding engines.

Dated 20th January, 1859.

175. T. Greenwood and J. Batley, Leeds—An imp. in the process of gassing textile fabrics. (A com.)

Dated 4th February, 1859.

314. M. Smith, Sun Foundry, Heywood, Lancashire—Certain imp in looms for weaving.
328. J. Honeyman, Glasgow—Imp. in the construction of ships, vessels, and boats, and in propellers for propelling the same.
330. W. Clark, 53, Chancery-lane—Imp. in the means or apparatus for preserving grain, flour, eggs, and other vegetable and animal substances.

Dated 7th February, 1859.

339. J. Holroyd, Leeds—An imp. in apparatus used in finishing woollen and other cloths.
341. W. H. Crispin, Marsh Gate Lane, Stratford, Essex—An improved atmospheric and hydraulic engine for sailing and steam vessels.
343. J. Lee, 18, Monson-street, Lincoln—Imp. in the manufacture of cranks for steam engines and other purposes.
345. E. T. Hughes, 123, Chancery-lane—Imp. in ovens. (A com.)
347. J. Wilson, 55, John-street, Sunderland—Imp. in ventilating mines, and in combining apparatus used for such purpose.

Dated 8th February, 1859.

349. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for sorting and numbering the threads or filaments of silk or other fibrous materials. (A com.)
351. G. Thomas, 47, Hamilton-street, Paddington—A double-bottomed horse-shoe.
355. J. Aspinall, Great Tower-street—An imp. in the refining of sugar.
357. A. Clark, Gate-street, Lincoln's-inn—Imp. in revolving shutters and blinds, and in apparatus connected therewith.
359. T. S. Cressey, High-street, Homerton—Imp. in machinery used in the manufacture of casks.

Dated 9th February, 1859.

361. E. Wilkins, 7, Addington place, Camberwell-road—Imp. in flower vases.
362. J. S. Joseph, Rhostyllan, near Wrexham, Denbigh, North Wales—Imp. in coke ovens, and in cooling and extinguishing coke.
363. W. Archer, Bolton—Certain imp. in Jacquard machines.
364. H. Jefferies, Birmingham—An imp. in castors.
365. J. Crossley, Halifax—Imp. in the means employed when steaming printed yarns.

366. J. Taylor, Stalybridge, and C. Wild, Oldham—Imp. in self-acting mules for spinning and doubling.
367. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in fire-arms. (A com.)
369. J. E. McConnell, Wolverton—Imp. in steam boilers and in the generation and treatment of steam.
370. W. E. Newton, 66, Chancery-lane—An improved mode of bleaching and purifying, or refining sugar and vegetable juices or extracts. (A com.)
371. E. Herring, the Heath, Weybridge, Surrey—Imp. in the mashing and fermenting of grain for the production of alcohol.
372. W. E. Newton, 66, Chancery-lane—Certain imp. in breech-loading fire-arms, and in cartridges to be used in such fire-arms. (A com.)

Dated 10*th February*, 1859.

373. H. P. Burt, Charlotte-row, Mansion-house—Imp. in railway carriages and waggons.
374. J. Young, Wolverhampton—An imp. or imps. in the construction of knobs, and the roses used for connecting knobs with doors, and with the cases of locks and latches, and other like fastenings.
375. J. G. Taylor, Paris—Imp. in writing materials, and the manufacture thereof.
377. R. J. Ellis, Liverpool—Imp. in the apparatus for lifting sunken vessels and other submerged bodies.
379. H. Inger, 3, Red Lion-square, Holborn—The imp. of blinkers used by horses whilst drawing, to be called the "Patent Safety Blinker." (A com.)
381. C. L. Perry, Sheepstead Farm, Marcham, Berkshire—An agricultural implement for paring and ploughing land.

Dated 11*th February*, 1859.

382. M. Billing, Birmingham, and W. Kloen, Aston, near Birmingham—A method of, and apparatus for, decolourizing tea.
383. J. Evans, Tarlton-street, Liverpool—An imp. in "Hansom" cabs.
384. J. Parkinson, Manchester—A certain imp. in coffins.
385. N. Bennett, 4, Furnival's-inn—Imp. in the construction of brooms or brushes for sweeping or cleansing streets, roads, and thoroughfares, also applicable to domestic purposes.
387. G. Hyde, 61, Fleet-street—A pen for producing a copy or copies of a letter or other writing simultaneously with the production of the original.
388. R. Cogan, Red Lion-square—Improved instruments for crushing and mixing solid and liquid substances.
389. H. A. Bartlett, Thetford, Suffolk—Imp. in machinery to be used with or without the plough for clearing and cleaning land from weeds.
390. C. Jackson, Store-street, Bedford-square—Imp. in the action of pianofortes.
391. J. Grimes, 6, Osborn-street, Whitechapel—Imp. in beer engines.
392. H. Ransford, West Brompton—An imp. in building ships and other vessels.

Dated 12*th February*, 1859.

393. G. Hadwen, Audenshaw, and J. Wadsworth, Droylsden, Lancashire—Imp. in Jacquard apparatus, applicable to power looms.
394. H. Lea, Birmingham—Imp. in changing or reversing motion.
395. T. Willis and G. Chell, Longsight, near Manchester—Imp. in machinery for spinning, twisting, doubling, and winding yarns and threads.
397. J. Crabtree, Market-street, Bradford—Imp. in the manufacture of bobbins and spools.
398. S. H. Huntly, Upper Baker-street—Imp. in cooking apparatus.
399. T. White and G. Jenkins, Portsmouth—Imp. in apparatus for raising and lowering ships along inclined slips.
400. J. Bennett and J. Bennett, Kingsland-road—An imp. in refrigerators for cooling beer and worts.
401. G. Betjemann, G. W. Betjemann, and J. Betjemann, Upper Ashby-street—Imp. in book slides.
402. W. G. Rawbone, Gloucester street—Imp. in fire-arms and ordnance.
403. G. T. Bousfield, Loughborough-park, Brixton—Imp. in revivifying the scarlet colour of woollen cloth lace and embroidery, in use for military and other garments and furniture. (A com.)
404. H. Gardner, 1, Old Quebec-street, Portman square—Imp. in machinery for breaking and preparing flax and other fibres.
405. R. Bell, Paris—Imp. in separating and recovering wool from fabrics composed of wool, or wool in connection with cotton and other vegetable substances.
406. W. E. Newton, 66, Chancery-lane—Imp. in breech-loading fire-arms. (A com.)
407. W. E. Newton, 66, Chancery-lane—Imp. in sewing machines. (A com.)

Dated 14*th February*, 1859.

408. J. Parkinson, Manchester—Certain imp. in coffins.
409. T. Hunt, Crewe, Chester—Imp. in steam boilers or generators, and in the prevention or combustion of smoke.
410. C. Sanders, Harford-street, Birmingham—Certain imp. in ornamenting English passepartouts for photographic pictures, also the glasses used with the same, and which said modes of ornamenting are also applicable to ornamenting photographic frames generally.
411. J. Wright, New George-street, Sheffield—Imp. in reducing and rolling steel and iron wire, and other forms of those metals in long lengths.
412. J. L. Clark, Haverstock-hill—Imp. in the means of working railway signals and switches.
413. J. Copcutt, 26, Kirby-street, Hatton-garden—Imp. in obtaining light from gases.
414. R. Clegg, Islington, F. Angerstein, Kennington, and J. W. Page, Walworth-road—Imp. in making soap.
415. A. B. Clarke, Edward-street, Blackfriars-road—Imp. in discharging sewage and water from lands into tidal rivers, and in flooding lands therefrom, also conveying sewage and other waters or liquids across canals and over structures, part of such said improvements being applicable as a substitute for sluice cocks and valves.

Dated 15*th February*, 1859.

416. E. H. Aldrich, Shoreditch—Imp. in ladies' dress caps.
418. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of steel iron and cast steel.
420. W. Raymond, 4, Albion-square, Dalston—An improved life raft.
422. J. T. Jones, Glasgow—Imp. in sewing machines.

Invention with Complete Specification Filed.

483. W. S. Clark, 76, Cannon-street West—Imp. in the formation of cast iron rails for city railways, and also in the method of uniting the ends of two adjacent rails for railway use. (A com.)—22nd February, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *Feb.* 25, 1859.]

February 25*th*.

1942. W. Esson.
1948. J. Fowler, jun., and R. Burton.
1949. R. Knight.
1955. G. Weedon and D. W. Rice.
1959. J. Brazil and J. McKinnell.
1960. G. Davies.
1961. J. Brazil and J. McKinnell.
1963. J. Oxley.
1964. G. Jones.
1965. J. L. Clark, F. Braithwaite, and G. E. Preece.
1966. E. Lindner.
1970. E. Spary.
1976. D. Heyworth and J. Heyworth.
1981. Capt. P. D. Margesson, R.A.
1992. J. Walker and J. Barnes.
1998. J. Robertson.
2008. D. Andrew.
2018. J. Shanks.
2032. W. Parsons.
2034. W. Parsons.
2040. W. Prisley.
2045. T. Timms.
2086. R. Lakin and J. Wain.
2107. J. G. N. Alleyne.
2122. A. V. Newton.
2154. M. A. F. Mennons.
2519. J. Buchanan.
2537. J. Buchanan.
2580. S. Hoga, W. P. Piggott, and S. Beardmore.
2848. W. E. Wiley.
2896. J. Kerr.
2936. J. Whitelaw.
2950. J. H. Johnson.
2969. J. Leck.
2998. J. H. Johnson.

[*From Gazette*, *March* 1, 1859.]

March 1*st*.

1984. W. Hobbs.
1994. J. Bleakley.
1997. J. M. Bellanger.
1999. W. Harkes.
2002. R. A. Brooman.
2005. R. A. Brooman.
2010. H. Hyde.
2014. J. Fielden.
2016. R. A. Brooman.
2020. J. Fyfe.
2024. F. W. Brind.
2082. J. Luis.
2123. J. Dewrance.
2441. N. Brough.
2460. E. Fielding.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette*, *Feb.* 25, 1859.]

February 21*st*.

466. T. G. Messenger.
469. J. Warburton.
529. H. A. Dewar.

February 22*nd*.

467. R. B. Jones.
470. H. Loveridge.

February 23*rd*.

460. E. Schischkar.
497. G. T. Bousfield.
505. T. T. Jopling.
509. I. Westhorp.
730. A. Tolhausen.
893. A. V. Newton.

[*From Gazette*, *March* 1, 1859.]

February 25*th*.

492. P. Schafer and F. Schafer.
506. F. P. Walker.

February 26*th*.

512. J. Fowler and D. Greig.
513. E. T. Archer.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4149	January 26.	Glass Bottle…………	Elias Lyons and Sons…………	The Peasley Glass Bottle Works, Sutton, St. Helen's
4150	February 9.	Parasol …………	William and John Sangster …	75, Cheapside
4151	,, 14.	A Bolt or Fastener…………	John Whitehouse and Son …	Birchall-street, Birmingham

Journal of the Society of Arts.

FRIDAY, MARCH 11, 1859.

EXHIBITIONS OF 1851 AND 1861.

The following letter has been addressed to the Chairman of the Council:—

My Dear Dilke,—Mr. Wm. Hawes has made some very interesting comparisons between the population in 1851 and the probable population in 1861, both in London and in the whole country, in order to show the increased prospects of success which would attend a second Exhibition, could it be made as attractive as the first.

The number of visitors, however, does not altogether depend upon the population, but upon the facilities offered for conveying that population to the Exhibition, and upon their ability to pay for such conveyance.

I do not know whether any computation has been yet attempted as to the number of visitors who were conveyed by railway in 1851, but certainly materials exist for it in Capt. Galton's reports to the Board of Trade.

Railway traffic has steadily increased, from 1849, as follows:—

	Separate Journeys in Round Numbs.	Increase.	Miles open.	Increase.	Journeys per mile.	Increase.
1849	64,000,000		5,579		11,442	
1850	73,000,000	9,000,000	6,326	747	11,515	73
1851	85,000,000	12,000,000	6,755	429	12,640	1,125
1852	89,000,000	4,000,000	7,113	358	12,531	*
1853	102,000,000	13,000,000	7,488	375	13,659	1,128
1854	111,000,000	9,000,000	7,846	358	14,160	501
1855	119,000,000	8,000,000	8,177	331	14,503	343
1856	129,000,000	10,000,000	8,502	325	15,213	710
1857	139,000,000	10,000,000	8,901	399	15,617	404
ASSUMED.						
1858	148,500,000	9,500,000	9,251	350	16,017	400
1859	158,000,000	9,500,000	9,601	350	16,417	400
1860	167,500,000	9,500,000	9,951	350	16,817	400
1861	177,000,000	9,500,000	10,300	350	17,217	400

* Decrease 109.

This gives a pretty uniform increase of 9½ millions of railway journeys a-year, and will show that three, if not four millions of the increase of 1852 was forestalled by 1851, for the latter number would be required to bring the increase of 1852 up to the minimum increase of any of the other years.

Again, the number of passengers per mile has increased as follows, in round numbers:—

1849...............	11,400	Total increase, 1,100. Average, 366.
1850...............	11,500	
1851...............	12,600	
1852...............	12,500	

Had the increase been uniform, the numbers in 1851 would have been only 12,132, giving an increase of 468 journeys per mile clearly attributable to the Exhibition, and this on 6,755 miles open that year, gives 3,161,340 journeys as the increase of travelling due to the Exhibition. Some of the journeys may have been due to visitors making excursions in the neighbourhood of London, but, on the other hand, a large proportion of the travellers must have paid more than one visit to the Exhibition, and there is, therefore, fair reason to assume, that one-and-a-half out of the six million visits to the building were from persons induced to come to London by the Exhibition, and the increase in the number of travellers was at the rate of $\frac{468}{12132}$, or nearly 4 per cent.

If the railways increase in mileage as they have increased during the last eight years, they will extend to 10,300 miles in 1861, and if the public continue to use those railways in the same increased proportion, there will be 17,000 travellers to every mile of railway. An increase of 4 per cent. on this would be 680 per mile or seven millions in 1861, instead of three millions in 1851.

It is, however, absurd to suppose that the country visitors to the Exhibition were only those who came on purpose. A large, and perhaps a larger proportion, must have consisted of persons who come daily to their business in London from the vicinity, or whom other pursuits may have called to London, and it is but a very moderate supposition that another 4 per cent. of the railway journeys of the year 1851 represented the ordinary travellers from the country who visited the Exhibition.

Thus there would be, supposing the attraction equal in 1861, 14 millions of railway journeys by visitors to the Exhibition against six millions in 1851, and, therefore, allowing two journeys, one up and one down, to each visitor, seven millions of country visitors instead of three millions, and the Exhibition of 1861 may afford to be less than half as attractive to command an equal numerical and pecuniary support from the country.

Assuming the remainder of the visitors of 1851 to be Londoners, and that they increased in proportion to the increased population of London, there would be four millions instead of three for London, and seven millions instead of three for country, which gives good ground for supposing that if the Exhibition of 1851 had taken place in 1861, it would have received eleven million visits instead of six millions.

I remain, my dear Dilke,
Very truly yours,
HENRY CUNLIFFE OWEN,
Lieut-Colonel R.E.

February, 1859.

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th of April next.

Persons intending to be Exhibitors should communicate with the Secretary of the Society of Arts as soon as possible, stating:—

1st. The Title of the Invention.

2nd. Whether the Article will be a Model, Drawing, or Specimen.

The Articles must be forwarded to the Society's house carriage paid. The days fixed for receiving them are Thursday the 7th, Friday the 8th, and Saturday the 9th April. No articles will be received after the last of these days.

Articles which have been included in previous Exhibitions of the Society of Arts cannot be re-admitted.

Articles should be accompanied by a short but clear description of the Invention, with a wood block (when possible) for illustration, and a reference to any publication in which the Invention is described.

All Drawings exhibited must be framed.

No charge is made for space, and the admission to the Exhibition is free.

EXAMINATION PRIZE FUND FOR 1859.

The following are the Donations up to the present date :—

	£	s.
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
— Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
Rev. A. Wilson	2	2

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Board has been appointed since the last announcement :—

For the Birmingham Institute.

The Rev. E. H. Giffard, M.A.
Mr. J. B. Hebbert.
Mr. J. Jaffray.
The Rev. J. C. Miller, D.D.
Mr. T. P. Salt.
Mr. G. Shaw.
Mr. J. F. Winfield.
Mr. W. Mathews, Jun., M.A., *Secretary.*

For Liverpool.

Mr. William Brown, M.P., Vice-President of the Society of Arts, *Chairman.*
Rev. J. S. Howson, M.A., Principal of the Collegiate Institution } *Vice Chairmen.*
Rev. Henry Griffiths, Dean of Queen's Coll. } *Vice Chairmen.*
Alderman William Bennett, 109, Shaw-street.
Mr. David Buxton, M.R.S.L., Principal of the Deaf and Dumb Institution.
Mr. Donald Cameron, M.A., Vice Dean, Queen's College.
Mr. Astrup Cariss, Secretary of the Liverpool Institute.
Mr. J. T. Danson, F.S.S., Eldon Chambers, South John-street.
Mr. William Gregson, M.A., 12, Duke-street South, Edge-hill.
Mr. Edward Heath, Orange-court, Castle-street.
Mr. Peter George Heyworth, 1, North John-street.
Alderman Samuel Holme, 10, Benson-street.
M. Eugene Husson, Professor of French, Queen's College.
Dr. William Ihne, Carlton-terrace, Upper Parliament-street.
Mr. James R. Jeffery, 43, Church-street.
Mr. R. A. Macfie, Leith Offices, 30, Moorfields.
Rev. Richard R. Moore, B A., 28 Rupert-lane, Everton.
Mr. H. Shimmin, Melbourne-buildings, North John-street.
Rev. Charles W. Underwood, M.A., Vice-Principal, Collegiate Institution.
M. Vittoz, Collegiate Institution.
Rev. A. Hume, D.C.L., and LL.D., 24, Clarence-street, Everton, *Secretary.*

For Salisbury.

The Mayor (for the time being).
The ex-Mayor.
Mr C. W. Squarez.
Mr. Style.
Rev. T. H. Tooke, St. Edward's, Salisbury, *Secretary.*

For Warminster.

Rev. T. E. Crallan, Grammar School.
Mr. John Farmer, High-street.
Mr. John Crispin, West-street, Warminster, *Secretary.*

FOURTEENTH ORDINARY MEETING.

Wednesday, March 9, 1859.

The Fourteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 9th inst., Wm. Ewart, Esq., M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Bolton, Francis S.
Mills, Robert.
Pickering, Charles Lewis.
Rücker, Hermann.

The Paper read was—

ON THE CAPE COLONY, ITS PRODUCTS AND RESOURCES.

By William Hawes.

I will not detain this meeting by an historical account of the colony of the Cape of Good Hope from any early period, for, if I am fortunate enough to excite an interest in its early history by a simple narrative of its present state, as I found it on my recent visit, and by my opinion of its future prospects, formed upon a careful examination of its resources, climate, people, and government, then it will be easy for anyone to obtain such information from sources open to us all.

I will, then, take up my subject from the period of the cession of the colony to us by the Dutch, in 1806.

From that date to 1813, the colony appears to have been prosperous. The first Kafir war had just terminated, and a line of stockaded forts along the eastern frontier protected the inhabitants.

Our military force was 4000 infantry and 1000 cavalry, the expenditure connected with which stimulated agriculture and commerce.

The cost of the government of the colony was, however, out of all proportion to its revenue, to the duties to be performed, and to its then apparent importance.

The salaries of the ten or twelve principal executive officers amounted to £30,000 per annum. There were great abuses also in the manner in which these salaries were paid, making the already heavy burden more onerous; and it was these high salaries, and the abuses above referred to, and the cessation of the war expenditure upon the withdrawal of the troops at the termination of the Kafir war, which caused the difficulties in which the Colonial Government was afterwards placed.

In addition to these pecuniary difficulties, great discontent existed throughout the colony from the very unsatisfactory, and, in many cases partial, manner in which justice was administered.

It was in Cape Town alone that important civil or criminal cases could be tried and decided; for, although minor cases could be tried in the local courts of each district, yet the vast extent of some of them, and the difficulty of travelling, rendered access to the courts difficult and precarious; and, frequently during the absence of the land-rost at sub-district courts, and of the commando on service against Kafirs or Bushmen, their places were filled by neighbouring yeomen, without any legal knowledge, and entirely unfit for the duty they attempted to perform.

Lord Caledon made a great effort to secure the proper administration of justice, and established a commission with power to decide causes, under which two members of the Supreme Court were to visit once every year each district in the colony.

The advantages which ought at once to have followed this wise measure were, unfortunately, deferred for a long time.

The first circuit through the eastern province was mainly occupied in trying indictments, originating with the missionaries, against members of almost every respectable family on the frontier, for aggravated assaults, and for the murder of Hottentots and other natives.

These charges, intricate in themselves, extending over a considerable period, difficult to prove to the satisfaction of a court of justice, but, if possible, more difficult to disprove, occupied the commission several months, and were not finally disposed of until the third circuit, when it was found that not one charge of murder had been proved, and only a few cases of assault and infringement of colonial law had been established.

It is not difficult to understand that angry feelings should be excited against the law, under which members of more than 100 families could be falsely accused of such crimes, and to exonerate themselves from which above 1000 witnesses collected from all parts of the province had to be examined, and heavy costs incurred, nor that feelings of disgust and bitter hostility should be excited against missionaries who had made such unjust charges.

This state of public opinion led to serious violations of the law, and to the insurrection of an entire district, which was suppressed by the execution, in the presence of a large assemblage of friends and relatives, of six of the leaders, at a spot still known as "Slackters nek."

These severe measures stopped the insurrection, but did not change the feelings of the boers or farmers, who were ready to take up any other grievance to perpetuate as it were their discontent.

Causes of grievance were not long wanting. I will notice three of the most important, and those which in the highest degree retarded the social and commercial progress of the colony. The first was the sudden substitution of English silver coin for the paper rix dollar, at the rate of 1s. 6d. per rix dollar, the dollar having been issued and hitherto recognised as of the value of 4s.

The next was the Hottentot grievance preceding, but leading to the abolition of slavery. This consisted in the establishment of educational missionary stations for the Hottentot population, to which they flocked in such unexpected numbers, as to deprive many farmers of their only labour for the cultivation of their farms.

Great as this evil appeared, yet, looking back now to what was effected, and admitting, to the fullest extent, the want of judgment and discrimination exhibited by many of the missionaries, it cannot be denied that the foundation was then laid for a great moral change among the black population, preparatory to the entire abolition of slavery; indeed, if nothing more was effected, the withdrawal of Hottentot labour from the north-western provinces induced the employment of another section of the African race—the bushmen—hitherto looked upon as savages irreclaimable from savage life, but to whom in a short time large flocks were safely entrusted.

This movement of the missionaries although causing great inconvenience to the boers, would have produced no permanent ill effect, but that about this time they saw steps taken by the Government tending to deprive them of the slave labour over which they claimed an absolute right of property.

I have not time to trace the various measures, many of them very ill-advised, which preceded the final abolition of slavery in 1833, but their effect was to destroy all the kindly feeling which had previously existed between master and slave. Perhaps the most offensive was the appointment, in 1830, of officers whose duty it was to hear any complaint a slave might bring against his master; to grant freedom indiscriminately to all who could obtain sufficient money to buy it, and to enforce penalties varying from £5 to £500 against masters neglecting the provisions of the ordinance, under which each slaveowner was obliged to record, in a book ordered to be kept for that purpose, every punishment inflicted on a slave, and to certify to the truth of such entry on oath, if required; and if the slave could establish a material error in these entries before such public officer, the master was subject to penalties for wilful and corrupt perjury.

Such was the excitement caused by this ordinance, that a body of between 3,000 and 4,000 slaveowners waited upon the Governor to demand protection against this impolitic law, which, although not repealed in consequence of this demonstration, was, as regarded its most objectionable enactments, allowed to become a dead letter.

About this time a voluntary effort was made in the colony to exterminate slavery. A society was formed for the purchase of young female slaves, with a view to apprentice them for three or four years, so that at the termination of their apprenticeship they should be free and able to provide for themselves.

From 300 to 400 girls were thus liberated, and had the Government assisted this society with funds, slavery would have been speedily but voluntarily abolished in the colony, and at a cost of scarcely one-tenth of what was subsequently paid amid the greatest possible discontent.

The act of 1833 was however passed; and had its provisions—compulsory as they were—been carried out as fairly as the appraisement of the value of the slaves had been made, disaffection would not have arisen, the depopulation of a district would have been prevented, and ultimately a large, wasteful, and useless expenditure by the mother country would have been saved.

The estimated value of the 35,745 slaves in the colony, by the commissioners appointed under the compensation act, was £85 each. The sum appropriated to meet this was £33 12s. per head; but this sum, due to Dutch boers residing in all parts of the colony, many of them living in distant and unfrequented places, could only be received at the Bank of England after the necessary proofs of claim had been established here.

A petition was sent home praying that the amount awarded to the colony might be remitted to the colonial treasurer, to be distributed by him to the Boers who satisfactorily proved their claims in Cape Town.

This reasonable request was refused, and the consequence was that Boers residing in all parts of the colony, having neither agents nor friends in England, were obliged to sell their claims to any one who would buy them for cash, obtaining in many cases little more than half the amount due to them under the reduced scale. The ill-feeling thus excited might easily have been avoided, and a great measure, affecting deeply-seated prejudices, and large pecuniary and social interests, might have been almost popular, notwithstanding the pecuniary loss, had it been brought into operation in a spirit of conciliation, and with an appreciation of the conveniences, interests, and wishes of those affected by it, but all of which were unfortunately disregarded.

The first practical effect of this measure was again to deprive the farmers of their labour. Their late slaves left them in a body. It was even difficult to retain sufficient labour to collect the harvest then on the ground. Farms were relinquished, masters were without servants, and the loss arising from the small compensation awarded was aggravated by the destruction of property from the want of the farm-labour to preserve it.

It is easy to imagine that events following one another so rapidly as the conversion of paper money into coin at an apparent loss, the disturbance of farming arrangements by the interference of missionaries with the Hottentots, the introduction by ordinance of most unjust and onerous relations between the slave and his master, by which the social and pecuniary interests of every farmer in the colony were disturbed and injured, and then the entire emancipation of the slaves, should cause an amount of disaffection towards a government which was viewed by many rather as a foreign power governing by right of conquest than as a government established for the benefit of the people.

With such feelings in the minds of the older settlers, especially of the Dutch, the report of a society established in Cape Town for the exploration of South Africa,—upon the capabilities of Natal for colonisation—was received with delight, and a party of Boers from the western province migrated eastward, intending to establish themselves in new localities, when the sudden commencement of the third Kafir war obliged them speedily to retreat.

This, then, is the third and last of those great disturbing causes which for a long period checked the progress of the colony.

The evils of the war were very much aggravated by the colonial policy of Lord Glenelg, who, in a despatch received early in 1836, not only condemned the conduct of the colonists, but described the invasion of the Eastern Province by the Kafirs as a justifiable act, and that they were right in endeavouring to extort by force that which they could not otherwise obtain. This impolitic and unjust statement was made in reply to an application to the Secretary of State for reparation to colonists for losses incurred in a most dangerous and hazardous war, of nearly 18 months' duration, the dangers of which they had shared equally with her Majesty's troops, and during which the loss of their property, according to official returns, amounted to—

456 farm-houses burnt and totally or partially destroyed.
350 partially pillaged and gutted.
5,176 horses
111,930 cattle } stolen or killed.
166,930 sheep

The refusal to entertain the application filled up to the brim that sense of injustice with which the colonists believed they had been treated by the Home Government, and laid the foundation for that emigration, or exodus, as it was called, of the best farmers and their people to Natal and other districts north of our Cape Colony in 1836-7.

It is generally believed that this suicidal conduct of Lord Glenelg towards the colony was attributable to the entire reliance which he placed upon reports he received from the missionaries, and which he incautiously trusted and acted upon, rather than upon those made by his own officers, and the all but unanimous testimony of the residents in the colony, both civil and military.

A better state of things, however, dawned upon the colony when Lord Stanley became Colonial Minister, and from this time, 1842-3, we may date the commencement of that rapid progress, the result of which to the colony, and its bearing upon the mother country, it is the main object of this paper to lay before you.

I propose, then, in order to give the clearest and most methodical idea of the present state of the colony and of its future prospects, to arrange my observations under the following heads :—

1. The government of the colony, including its political institutions and its laws, as affecting social progress.

2. Its religious and educational institutions ;
3. Its climate, agriculture, trade, commerce ;
4. Its aborigines ; and
5. The advantages it offers to emigrants ;

and I hope to show that there are elements for personal success and distinction peculiarly adapted to the English character, and for all those who, by intelligence and industry, will place themselves favourably before their fellow citizens, which exist in a greater degree in no colony, and in few, if in any, to the same extent.

I. The Government.

Having brought the history of the colony down to the period when the application for representative Institutions was approved by the home government, I will devote a few sentences to show how rapidly and successfully they have come into operation, and how intuitively almost the colonists have responded to the call to take upon themselves the duties and responsibilities of self-government.

From 1806 to this time (1852), the colony had been governed by a Governor or Lieutenant-Governor, and a few other executive officers, nominated by the Crown, and irresponsible to the colony.

It has now a Governor and an Executive Council; a Legislative Council of 15 members, eight representing the Western and seven the Eastern Province, presided over, *ex officio*, by the Chief Justice; and a House of Assembly of 46 members, representing the towns and country districts of the colony.

The Colonial Secretary, the Attorney-General, the Treasurer-General, and Auditor-General, have seats in both houses; they can take part in the debates and introduce measures, but cannot vote. They hold their offices under the Crown.

The qualification for members of the Legislative Council is the possession of unencumbered property of the value of £2,000. The members of the House of Assembly, of whom no property qualification is required, have an allowance during the sitting of Parliament, and for travelling expenses, amounting together, in 1857, to £2,882 14s.

The qualification for an elector is the occupation, for 12 months previous to the registration of voters, of a house or land of the value of £25, or the receipt of a salary for the preceding 12 months at the rate of £50 per annum.

The first parliament elected under this constitution has just expired, and by comparing the progress of the colony during the five years of its existence with that of the preceding ten years, we shall find strong grounds for reliance upon those principles which place mainly in the hands of the governed the power to determine what laws are most likely in the highest degree to promote their own prosperity and happiness, and with them the material interests of the colony in which they live.

I do not mean by these observations to imply that the principle of self-government is yet so fully developed as it may be in a few years, if the Legislative Council and House of Assembly, presided over by so able a Governor as Sir George Grey, continue to be animated by the loyal and conservative, but still popular and progressive principles which have guided them during the past five years, but before any further important change can be made, population and occupation must increase, so as to afford a wider basis than now exists, for a more numerous House of Assembly, and for the choice of executive officers.

The first test of the progress of the colony is to be found in its revenue. From 1834 to 1844, it rose from £119,583 to £221,721; from 1845 to 1857, from £247,369 to £406,702.

But to trace more clearly the effect of local government, and the stimulus it has given to industry in the colony, we must subdivide this last period into two parts, 1845 and 1851, and compare this period with that from 1852 to 1857, by which we shall find, that in the first six years the revenue was rather decreasing than otherwise, the amount collected in 1845 having been £247,360, and in 1851 only £234,934, whilst that collected in 1852 was £289,482, and in 1857, £406,702. This prosperity arose concurrently with the cessation of the Kaffir war and the introduction of the new constitution, which, by placing the management of the affairs of the colony in the hands of the people, gave an impetus to improvements, to the opening of new passes, and the repair of old roads, by which tracts of country scarcely accessible before were brought into commercial relationship with the coast and shipping ports.

The extent to which the resources of the colony have still to be developed by such means, those only who have visited it can appreciate.

The attention given by Parliament to local matters, is indicated by the great public works either in progress or in preparation, among which the railway to Wellington, 100 miles in length; the formation of docks, and a harbour of refuge in Table Bay; increased accommodation for landing and shipping at Port Elizabeth, and the tidal works at the Kowie, are the most important.

I have dwelt somewhat at length on this part of my subject, because I feel it has a most important bearing upon the future prospects of the colony, especially in its operation upon settlers; for I found upon inquiry that, until this field for the exercise of public spirit was open, no one appeared to consider the colony as his home. Attachments to the country and soil were not formed, and the greater part of the most active and enterprising men in the colony looked upon their residence there as of a temporary character, and never thought of the really permanent interest of the colony; for, no matter what disinterestedness, intelligence, or public spirit might be exhibited, it was impossible for any one to obtain a share in the Government.

Now the case is different, and the principal merchants in Cape Town seek for seats in the House of Assembly, that they may maintain the influence in the affairs of the colony their mercantile position requires.

It is needless to point out the great stimulus to exertion which such an object of ambition must afford to settlers from England, where the highest offices of state are open to all, and where all are accustomed to look to the attainment of political distinction as the most honorable result of successful enterprise, and of attention to public and local affairs.

The effect of this change is, as yet, hardly appreciable; but still in society it is silently working its way, and ample evidence is afforded of the benefits it has already conferred, and the still greater benefits it will confer, by the interest which is being taken in all colonial improvements, and the greater and increasing interest which political, as well as social and commercial questions, are exciting in the minds of all. This will be best shown, perhaps, by the facts I shall produce in illustration of the progress of the newspaper press.

Twenty years ago there was but one newspaper in the colony; that was published under the direction of the Government, and rarely contained any political information.

Now there are eight newspapers published in Cape Town during the week, four of which are printed by steam, and issue together 3,500 copies daily, except on Friday, when the *Gazette* only is published, the circulation of which is 1,400 copies.

Besides these, there are 16 country papers and 4 monthly magazines.

The most important of these papers is the *Argus*, established since the introduction of representative institutions, and which has justly earned a reputation and large circulation in a very short time, by its bold and independent criticisms on all public measures and public men. It has three issues weekly, a number not likely to be increased until a daily post is established throughout the colony. It is a liberal paper—the proprietor and editor being a member of the House of Assembly.

The next subject to which I must refer, and which, in my opinion, affects the progress of the colony, and tends to retard the adoption of the country by English settlers as their permanent home, is the law which regulates the disposition of property by will.

The Roman Dutch law, as a rule, is the civil law of the colony. This, in the course of time, has been modified in its relation to English settlers by ordinances issued under the authority of the home Government, and which, when published in the *Gazette*, became law.

Many of these ordinances were merely extracts from despatches loosely worded, and written evidently without any idea of their being published in that form as colonial laws.

The ordinance of 1822 relating to the marriage of, and the disposition of property by, English settlers, is one of this description, and is now giving rise to much litigation, which must increase yearly as parties die, who, having married under it, and believing they retained all the rights of disposition belonging to them in the mother country, have left that which now appears to be an illegal disposition of their property.

This subject, however, although strong opinions are held by the supporters of the Roman Dutch law, as well as by the more English section of the colony, is being discussed in the papers, in the magazines, and in the assembly; and will no doubt in a short time receive a solution which will secure to the colony the best parts of both systems.

Another subject, of great importance to the welfare of the mercantile interests of the colony, and which is also receiving the attention of the legislature, is the present limitation of the maximum rate of interest by the usury law. The principles of free trade are, however, at work here, and no doubt ere long the trade in money will be released from restrictions, and be allowed to find its value in the open market, like any other commodity.

There is, however, one branch of the law in which the colonist can boast of great superiority over the mother country, and that is in the forms required for the transfer of land.

The colony having been surveyed, and official maps deposited in a public office at Cape Town, no transfer of land or incumbrance upon it is legal unless it is registered in this office, and marked off on the public map of the colony, and all that a buyer has to do to obtain possession of landed property, is to ascertain at this office whether the property he is negotiating for is the *bona fide* property of the seller—what incumbrances may be upon it—whether the description by the seller be correct, and then, by showing his right to the property by purchase, he receives from the registrar a legal transfer of the property, with a plan and description appended.

These particulars are filled into printed forms, occupying one or two sheets of foolscap paper, and the most perfect title may be thus obtained in a very short time at a very trifling cost, and be easily carried away in the buyer's pocket.

The dealings in landed property are most frequent. Mortgages are the favourite security of the colony, and the acquirement of land by all classes is very much facilitated.

There are fixed fees paid on each transfer, but their amount is too small to detract from this most facile and perfect system for the transfer of land.

The last portion of this division of my subject relates to the sources from which the revenue is raised.

The gross amount raised in 1857 was £406,702, of which

£	
254,178	was derived from customs.
47,658	was derived from transfer duties.
24,490	was derived from auctions.
23,841	was derived from licences.
10,705	was derived from fees of courts.
15,602	was derived from post office.
5,598	was derived from sundries.
24,630	land sales and land revenue.
£406,702	

Nothing can be more easy than the collection of this revenue. There are so few ports that the customs staff is small, and as almost every article of manufacturing industry is imported, the bulk of this taxation falls on the more wealthy classes, for except at Cape Town, Port

Elizabeth, and Grahams Town, the native population can scarcely be included among the consumers of English manufactures.

2. The Judicial, Educational, and Religious Institutions of the Colony.

These are of equal importance to the old settler and to the emigrant.

The protection of life and property, the judicious treatment of crime, especially among the native population, and the moral and intellectual character of the rising population of all classes and colour depend upon them, and the facility for obtaining a good education for children ought to have great weight in the choice of the country or colony to which an intending emigrant should go.

1. *Justice*, as between colonists, appears to be well and impartially administered by a Supreme Court, presided over by a Chief Justice appointed by the Home Government, four puisne judges, and by stipendiary magistrates or civil commissioners, residing in the principal towns and districts, before whom all minor civil and criminal cases are decided. These officers are appointed by the Government, and appear, as far as my observation went, to be popular in their respective districts.

No doubt the judge, especially if on his first circuit, has great difficulties to contend with, and if he has not previously studed the Kafir character he is apt to apply English practice and principles when deciding a case between a master and his Kafir servant, in a manner utterly subversive of all discipline between them, and calculated to encourage not only insubordination, but a spirit of combination and union likely to produce serious results to the colony.

Whilst justice is done to the native, the Kafir character should not be forgotten—falsehood, cunning and theft, hatred of the whites, and blind superstition, are its leading characteristics—and unless, in the hearing and decision of complaints by them against their masters, their character is thoroughly appreciated, great injury and injustice will be done to the white population. The plausibility of a Kafir in court is remarkable; his energy, his coolness and bold lying require an experienced judge to understand, and a firm, though not harsh or severe judge, to mete out due punishment for their offences.

The number of causes decided by the courts—

	Civil.	Criminal.
In 1854 was..........	2,927............	5629
,, 1855	3,278............	6179

2. *Education.*—There are distributed over the colony, 156 schools of all descriptions, with 16,641 scholars, 8,117 males and 7,755 females; the average daily attendance being 10,465, and towards the support of which £10,682 was appropriated by the Local Legislature in 1857, besides £1 000 to border schools and school buildings, and £2,300 to geological and botanical objects.

This list includes the Government schools and those supported by different sects of Christians.

It is impossible, in a paper of this nature, to enter into the details of the instruction given at these schools, but I may truly state that the present Governor neglects no opportunity of promoting the education of all classes; and the encouragement he is giving to the establishment of a College and University, where the higher branches of education may be obtained, is deserving of great praise; and the plan proposed by the commission he issued to inquire into and report upon the appointment of a Board of Examiners to select, by public competition, proper candidates for vacancies in the public service, and to grant certificates of merit and attainments in science and art will, when carried out, open to all classes the advantages of official life and the attainment of educational honours.

The adoption of the competitive system as a test for admission to the public service, just as the colony is rising into importance, and when a wider choice of occupations for the young men of the colony is wanting, cannot be over-rated.

The commission also inquired into the remuneration paid to clerks in the public service, and, without materially altering the sum paid to each clerk in the first ten years after his appointment, they so arranged the annual payment as to offer inducements to young men to enter the public service in some proportion to the increased qualifications required of them.

Religious Institutions.—The sum voted in 1857 for the support of public worship was £15,678. It was distributed among the Episcopalians, the Dutch Reformed and Calvinistic, the Lutheran, the Wesleyan and Roman Catholic Churches, the two first receiving a large proportion of the whole amount.

The number of the congregations is returned at 147,871, and the average attendance at 38,379. The coloured inhabitants are chiefly Mahomedans. In Cape Town they have two or three mosques; and there are others in the country towns. There are eleven distinct Missionary Institutions in Cape Town, and each sect has agents in various parts of the colony. And if such men as Dr. Livingstone, Messrs. Moffat, senior and junior; and Mr. Calderwood, could always be found to devote themselves to missionary work, there could be no doubt as to the benefit the native population would, in time, derive from their exertions. But, so far as I could see, the greater number of missionaries are appointed to a most difficult duty, requiring the exercise of the highest functions of the mind and most varied knowledge of people and things, without any previous preparation or evidence of fitness, and without any knowledge of the people or country to which they are sent; and, for want of this experience and knowledge, they appear to me to have mis-conceived the mode in which the native population are to be gained over to civilisation and Christianity.

I fear that hitherto missionary instruction has done little to improve the condition of the native population, and time is still required to remove the prejudices which in times past were excited against the white man.

The tendency of their instruction was often to create distrust in the minds of both. They did not devote themselves to the inculcation of the duty of kindness on the part of the masters to the natives, nor did they teach the duty of submission to, and reliance upon masters by servants, but they rather sought to obtain power for themselves over the black population, imagining they could direct them better than their masters, and thus, very often with the best of motives, excited an amount of ill-feeling which time can alone remove.

They have begun with preaching the dogmas of sects instead of first gaining the confidence of the black man by proving the superiority of the white man in general, knowledge—in medicine, by curing disease; in mechanics, by his ingenuity and skill in the use of tools, and making contrivances for his comfort; in agriculture, by pointing out fertile places previously unknown, and introducing improved modes of cultivation; in his morality and love of justice; thus proving practically to the natives the power which the education of the Christian gives over the ignorance of the heathen.

It is, however, very satisfactory to find that, in the rivalry of sects, the Church of England, under the able superintendence of the bishop, Dr. Gray, by whom the native character is well understood, is fully maintaining its position and its usefulness in the colony.

3. The Country: its Climate, Agriculture, Trade, and Commerce.

The first distinguishing feature in the country which strikes an Englishman is the want of trees and water. These deficiencies give the country a barren and wild aspect, —so much so, that it is difficult at first to believe it can support animal life, and be so productive, as a more intimate acquaintance with it proves to be the fact. There is, however, so beautiful a natural phenomenon affecting the supply of water to Cape Town, that I cannot avoid referring to it.

Table Mountain is the terminus of a ridge of high land, which almost covers the promontory of the Cape of Good Hope. Its face towards the north-west, immediately behind Cape Town, is all but perpendicular, nearly 4000 feet in height.

When a cold south-east wind blows over this ridge, and comes to the edge of the cliff, it meets the warm air, saturated with moisture, which is constantly rising from Table Bay and the basin in which Cape Town is situated, and immediately condenses this vapour first into a cloud and then into rain, which falls on the mountain edge and on the *débris* immediately below it.

This cloud, to observers in the Bay or in Cape Town, appears to be moving forward with a curling motion, precisely as though it were pouring over the mountain, with this peculiarity, that it rarely advances far from the cliff, or descends below a certain point, where it meets the upward current of warm air, which again absorbs the dense vapour to be again cooled, and then deposited as mist or rain; so that what appears to be a heavy cloud, driven over the mountain by the south-east wind, is a beautiful contrivance of nature for the supply of Cape Town and the shipping resorting to it with the purest and most delicious water, for the water issuing from the débris at the foot of this mountain, resting as it does on granite, is the only source from which all the water for the supply of the 30,000 people living below it is obtained. It is most curious to see this cloud during perfectly fine weather, and when no other cloud is visible for days and weeks, constantly hovering over the mountain, and as regularly depositing its water for the large population dependent upon it.

The want of trees is in a fair way of being supplied by the very active steps which are being taken to surround every homestead with the blue gum-tree, the growth of which is so rapid that, in a few years, in all probability, the general aspect of the country will be altered and improved, and an important effect produced upon the climate of the colony.

These trees grow in ten years to a height of 60 or 70 feet, according to the soil and situation, with an average diameter at the base and for the first 20 feet, of 12 inches, large enough to be cut into useful planks. The wood is hard, close-grained, and resinous, and appears calculated to stand the action of weather, and to be fit for general use.

For many miles north and east of Cape Town the country is covered with a small shrub from two to three feet in height, called the rhinoster bush, under the protection of which sufficient grass grows at all seasons for the food of sheep, &c., &c.

As you advance to the eastward, the rhinoster bush gives way to some extent to the mimosa bush, which grows to ten, twelve, and fifteen feet in height, and, except to natives, appears to be almost impenetrable from the sharp and strong double thorn with which it is covered.

But, if trees be wanting in the Colony, flowers abound. Their colours are so brilliant, that they produce a striking effect in the landscape, and their beauty may be appreciated, though inadequately, by the specimens of Cape heaths and bulbs we see in our hot-houses. But these beautiful flowers, indigenous to the colony, are intermixed with almost every common flower with which the eye of an Englishman is familiar. There are two flowering shrubs, however, with which we are not so familiar, and which from their abundance, and the very striking effect they produce in the landscape, I must particularly mention, viz., the protea or sugar plant, and the aloe. The aloe, with its brilliant crimson flower, on a conical stem, grouped generally in masses covering rocky mountain sides, is particularly beautiful, whilst the protea, with its white, pink, and black flower, is equally beautiful on the open country.

There are three ranges of mountains one behind the other, running almost parallel to the sea from east to west, which appear to protect the colony from the hot wind coming over the northern karoos or sandy plains. The valleys between these ranges are each higher above the sea as they advance northward, and afford gradations of climate and soil suited to the cultivation of almost every description of produce required for the sustenance of man, and for the increase of his wealth by commerce.

As a whole, then, although there is much wanting to complete a picturesque landscape, there is grandeur and harmony of form and variety of colour, producing an agreeable sensation in the mind as you travel over the country; and as most of the trees in the mountain kloofs are evergreens, of a brilliant but deep green colour, there is not the difference in the landscape in winter and summer to which we are accustomed.

The agriculture and trade of a colony, and the inducement it offers to emigrants, are so dependent upon its climate that I have taken some pains to collect all the meteorological information which exists relating to the colony, and for the returns to the latest date I am obliged to Mr. Maclear, the Astronomer Royal.

There does not appear to be an accurate meteorological register kept in the colony except at the Royal Observatory. The thermometer has been recorded daily for the last few years with the general aspect of the weather, at the Exchange-rooms in Cape Town, where I obtained the following results for 1856 and 1857:—

1. There were in the 12 months in

1856, 223 absolutely fine days.
1857, 218 ,, ,,
1856, 13 Cloudy, absolutely overcast.
1857, 21 ,, ,, ,,
1856, 18 Cloudy, with sun.
1857, 13 ,, ,,
1856, 36 Cloudy and rain.
1857, 50 ,, ,,
1856, 18 High wind.
1857, 8 ,,
1856, 57 Sundays and holidays; no register kept.
1857, 55 ,, ,, ,, ,, ,,

2. The range of the thermometer during the day, reduced to monthly averages, is—

	9 a.m.	12 Noon.	4 P.M.
January	71· 8	73·53	75·19
February	77·16	79·44	79·56
March	68·11	69·88	71· 5
April..................	71·61	74· 2	74·76
May	63·26	65·42	67·
June	60·45	62·66	63·87
July	58·34	60· 6	62·03
August	57· 5	59·96	61·03
September..	63·	64· 5	65·46
October...............	65·92	67·36	68·62
November............	67· 2	68·84	69· 2
December	72·36	74·45	75· 8

These figures may, I believe, be considered as giving a fair idea of the temperature of Cape Town, but the following table, compiled from the observations of the last 14 years, made most carefully under the superintendence of the Astronomer Royal, at the Observatory three miles from Cape Town, must be more accurate as regards the general character of the climate:—

	Mean of each Month.	Highest and Lowest of Maximum each Month.		Highest and Lowest of Minimum each Month.	
January	68·77	94·7	81 4	60·4	52·4
February............	68·99	97·4	78·6	61·6	51·5
March	66·29	91·2	77·8	55·6	46 7
April	62·95	91·4	73·0	52·6	45·0
May	58·01	85·2	64·4	48·6	41·0
June	55·35	77·2	65·5	44·6	37·7
July...................	54·57	75·4	62·7	44·2	38·0
August	51·21	76·8	62·2	45·1	38·0
September	57·43	83·0	69·4	48·9	40.0
October	61·06	86·2	73·0	50·8	43·7
November	64·28	93·6	72·6	56·8	46·0
December	67·61	96·8	74·9	59·0	48·6
Mean	61·71				
Mean temperature of England	62· 0				

Whilst, then the average temperature of fourteen years is even a trifle below that of England, there are not the extremes of this country, as the average temperature of winter is but 14·42° below that of summer.

The mean daily range is 10·32°, and the mean greatest daily range during the fourteen years was 25·5°.

The annual average quantity of rain is 23·309, the maximum 32·467 in 1850, and the minimum 18·783 in 1844.

The mean monthly degree of saturation is 75·14. The maximum 100 in 24 months, during the fourteen years, and the minimum 51·17.

There is lightening on 13 days in each year.—
16 being the maximum, and
7 ,, ,, minimum number of days.

The mean force of the wind per square foot, for 14 year, is 1·30 lb. Monthly maximum 1·87. Extreme maximum, February, 1856, 2·97.

By these facts it is established, not only as regards temperature itself, but as to the range of temperature, daily and yearly, and the amount of rain and wind, that there is nothing in the climate unfavourable to an English constitution, but on the contrary, they prove it to be a healthy climate, without violent changes from heat to cold, without extremes, for the few hot days of summer are almost always tempered by light airs, and ample moisture morning and evening; indeed, experience proves that in numerous cases the early symptoms of consumption have been so entirely eradicated that robust health has followed a residence at the Cape, when to have remained here, increasing weakness and premature death appeared certain.

The climate, then, is peculiarly favourable for emigrants, for during ten of the twelve months no fire is necessary but for cooking, and so certain is the weather that the smallest provision against inclemency is required, by which many of the hardships a settler must bear and overcome in a more rigorous climate are here unknown.

To this temperate and even climate we owe the suitability of this colony for the production of wool and wine, and for the breeding of sheep, cattle, and horses.

As existing roads are improved, new and shorter roads made from the interior to the coast, so the demand for trek-oxen will decrease, and their place will be supplied in the grazing districts by horses, for which the demand since the war in India, has been very large, 3,059 having been shipped to Calcutta and Bombay, between August, 1857, and April, 1858, and of which but 26 died at sea, and as the Indian Government has now determined to make the Cape a remount station, it will easily, in a year or two, obtain 5,000 useful cavalry horses annually, at a very moderate price.

The native horse of the colony would not satisfy the eye of an English remount officer, but his endurance during the longest and hottest day surpasses almost any other horse; and it was because the buyers sent out in the first instance were quite ignorant of the peculiarities of these horses, that nearly all brought forward by the farmers were rejected, and a most abundant source of supply lost for a time to the Indian army. It was, however, soon shown that a considerable number of the best horses of one of our cavalry regiments which were sent from India to the Crimea, and which arrived there in good condition, were imported from the Cape eleven years before.

The horse is small; is generally brought for inspection in very bad condition, and requires a thoroughly honest and good judge of horses to do justice to the breeders and dealers, and to protect the Government. This the Company has secured in Colonel Apperly and Lieut.-Col. Good.

The rapid increase in the quantity of wool, from 113,000lbs. in 1833, to 7,700,000lbs. in 1853, and then to 18,000,000lbs. in 1858, a quantity which will probably be surpassed in 1859, proves the suitability of the climate to the breeding and rearing of sheep.

The increase in the number of cattle and of sheep, may be measured in some degree by the number of hides and skins exported; the number of hides in 1853 being 5,278, and in 1856, 96,218; and of sheep and goat-skins, 168,708 in 1854, to 766,000 in 1856.

Then, again, this climate so favourable to animal life, is equally so to vegetable life. More than sufficient corn of all descriptions is now grown for the wants of the colony. The importation of American flour has nearly ceased; whilst on the other hand 1,000,000lbs. of flour, 800,000lbs. of bran, 1,500 quarters of barley and beans, and 3,116 quarters of oats were exported to the Mauritius in 1857.

So with the vine—the export of wine has increased from 106,067, gallons in 1854, to 797,092 gallons in 1857, and it may be safely stated that but a mere spec of the land suitable for the growth of corn and wine, for feeding cattle and sheep, is yet rendered productive. One of the finest wine districts (Oudts horn) has only just become accessible to the dealer Every new road or pass opened will in a few years afterwards increase enormously the surplus quantity of agricultural produce available for exportation. Another useful product of the soil is Aloes, the export of which has increased from 9,319lbs. in 1853 to 497,079lbs. in 1857. The total quantity produced in the colony in 1855 was estimated at—

Wheat......................	994,273	Bushels.
Barley and Rye............	400,237	,,
Oats and Maize............	2,501,320	,,
Wine	34 221	Pipes.
Brandy	5,496	,,

And the stock of horses, cattle, sheep, goats, and pigs at:

Horses.................................	139,777
Cattle	450,048
Sheep	6,500 000
Goats	1,249,455
Pigs	35,000

The power to increase these already large figures may be best illustrated by comparing the actual area of the colony with the number of acres under cultivation.

The total area is 126,930 square miles, or very nearly 80,000,000 acres. That under cultivation is in

Wheat	73,908
Barley	19,039
Oats and Maize	70,172
Vine	11,853
Orangeries and gardens	11,320
	186,292

The connection of the trade and commerce of the colony with its agricultural prosperity is too close not to advance with it, and we find, therefore, that our exports to the Cape have increased from £985,266 in 1854, to £1,602,607 in 1858; and by comparing this with the population, we find the average consumption per head of British manufactures in 1858, was just £6, nearly half the population being coloured, and, of course, comparatively small consumers.

To facilitate the management of this increasing trade, the colony is well supplied with banking accommodation. There are 16 Joint Stock Banks, the shares of which are all at a premium, and some at high premiums.

If we compare the consumption of British manufactures with that of other colonies, the importance of the Cape Colony will be strikingly exhibited.

Thus, the population of the Cape is 267,000. The value of our exports, £1,602,607, or £6 per head. Or if whites only are considered, fair allowance being made for the supply of the coloured people, it is above £10 each, whilst in—

	Population.		Value of our Exports. £		Per head. £
New South Wales...	350,000	...	2,919,325	or	8·34
Victoria	500,000	...	5,419,354	,,	10·83
British North American Colonies ...	3,000,000	...	3,159,055	,,	1·015
Mauritius	226,000	...	601,399	,,	2·66
West Indies	850,000	...	1,791,931	,,	2·11
United States	24,000,000	...	14,013,983	,,	0·59
France	36,000,000	...	4,861,558	,,	0·13

With the exception, then, of Victoria, there is no colony which consumes per head so large a quantity of English manufactures, and there is every reason to believe this proportion will increase as population increases; for, as the climate, soil, and the physical features of a country mainly determine the employment of a people, so here the absence of rivers, the want of coal and iron will make agriculture the most profitable occupation, and the colony will export, as its population increases, larger and larger quantities of wool, wine, hides, horses, corn, &c., importing, on the other hand, in as rapidly increasing quantities, our manufactures.

In comparing the imports to the Cape Colony with those of our Australian colonies, we must, in justice to the Cape, show the nature of them. Thus Victoria, out of a Customs revenue of £1,777,000, receives

£807,000	for duty on	Spirits
70,000	,,	Wine
15,000	,,	Beer
172,000	,,	Tobacco, Snuff, & Cigars
£1,064,000		

whereas the Cape, with its Customs revenue of £260,000 collects only £22,500 from the same sources.

Besides the trade with England, the Cape supplies the Mauritius, in return for its sugar, with dried fish, which are caught in innumerable quantities in Table Bay, and with corn. It imports its coffee, rice, and tea from India and South America.

Until within the last few years, Cape Town was the only port of the colony, but now Port Elizabeth is a formidable rival, whether in the business transacted or the population of the town, for although it is as badly placed as possible, there being scarcely a shrub, much less a tree, within several miles, still on either side it possesses most luxuriant districts, wanting only capital and labour to produce everything that can be required.

The fertility of Uitenhage, 20 miles from Port Elizabeth, can be rarely excelled, and an extensive district is there waiting for the introduction of the vine, or rather for labour to cultivate it, to be converted into one of the most useful and profitable localities in the colony.*

But if Port Elizabeth is thus rivalling Cape Town, other new ports are opening destined in their turn to rival it. The Kowie on the east, and Mossul Bay and Plattenburg Bay on the west, will, in their turn, rival their older neighbours. But I believe that, in a few years, so rapidly are new districts being brought into connexion with these ports, that there will be business enough for all, even if Port Elizabeth continues to increase as it has done, and Mossul Bay and the Kowie increase as rapidly.

These two ports deserve a few words of description, for they both illustrate the effect which the increased energy and enterprise directed towards public improvements during the period I am illustrating has produced.

The Kowie is a harbour now in course of formation, under plans approved by the late Mr. Rendel, and which, when finished, will afford, at all times, protection for shipping of from 400 to 600 tons burden, with great facilities for loading and discharging cargo, there being above twenty feet of water alongside the quay at low water.

These works are being executed by a local joint stock company, and if their success be as great as may reasonably be anticipated, the resources of hitherto unproductive but most fertile parts of the colony will be rapidly developed.

The mouth of the Kowie is thirty-five miles south-east of Graham's Town, to which capital of the eastern province it is likely to become the port.

Mossul Bay, with the exception of False Bay and Simons Bay within it, affords the best protection for shipping on the southern coast of the colony. As a bay, in point of size it is inferior to Algoa Bay, but for that reason it is more sheltered and safer for shipping. Indeed, Algoa Bay hardly deserves the name of a bay. It is little better than an open roadstead, scarcely sheltered from any wind from a few points to the south of west to the same points south of east; this drawback to it as a port being overcome by its remarkably good anchorage. It has at present no sufficient landing or shipping pier. Every cargo is loaded and discharged in boats, and carried from the boats to the shore on Kafirs and Fingoes backs, and in the same way every passenger arriving there, excepting in the finest weather, is carried ashore.

Now, Mossul Bay is very much more protected, and could easily, and at very little expense, be made a fine harbour of refuge. Its anchorage is as good as that of Algoa Bay, and boats can land passengers at all times of tide in comparatively smooth water at the shipping jetties already erected under the shelter of the rocks.

But this bay was comparatively useless until passes were made through and over the mountain ranges behind it, for the country naturally open to it is of too limited an extent to produce sufficient to induce ships to call there for it. But this state of things is already materially changed by the opening of the Meerings Poort, and will be still further improved when other new roads, now in course of construction, are finished. These will bring the Beaufort and other important grazing and agricultural districts within 8, 10, or 12 days' waggon distance of a fine port, and this time will be lessened as the roads, now new and imperfect, become sound and consolidated.

I cannot refrain from dwelling a few moments upon the most important pass to which I have alluded, and which was only opened about two years since, and is yet scarcely finished.

This pass or poort is a natural way through, not over, a mountain chain. Its existence until very recently was unknown except perhaps to a few Hottentots and the Boer into whose estate on the southern side of the range it opens, and whose name it now bears, from his son having been the first white man who thoroughly explored it, and ascertained that a road could easily be made through it.

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* The following is but a very imperfect list of fruits and flowers I saw growing in a garden in the open air:—Violet, primrose, hyacinth, roses (all colours), jonquil, magnolia, camelia, geranium, mignionette, sweet pea, dahlia, protea, peaches, apricots, oranges, loquot, limes, natchez, coffee, quince, cotton, peas, beans, carrots, figs; hedge of peach, quince, figs, orange, alternately.

This pass then is through the great Zwartberg, or Black mountain range, the third range northward from the sea, the maximum height of which for many miles in length is about 5000 feet. Now this range at nearly its highest point is split open transversely from top to bottom, the base line along which the road winds, by the side of the water course running through it, being about 15 miles in length, ascending in its course from the entrance on the southern side to the Great Karoo, or sandy desert on the northern, 500 feet. The sides of this cliff are for a considerable portion of the distance almost perpendicular, and appear with scarcely any exaggeration as though the mountain chain had had been at a comparatively recent period cracked in twain. In the centre of the pass, and at its narrowest point the fissure is just 90 feet in width.

There may still be, and most probably are, other unexplored but similar fissures in these mountain ranges, through which in time roads and railways will run, bringing the produce of immense inland tracts of country to the sea-ports for distribution all over the world.

In mineral productions the Cape Colony, as a whole, appears deficient. Its wealth is to be found in its climate, soil, and products, and not in its mines. Still, in the north-western corner in Namaqua-land, in latitude 29° south, copper in considerable quantity is found, and the shipments of ore have increased from 11 tons in 1852 to 3500 tons in 1857. This, however, is the only instance of mineral wealth; and the district in which it is found is so inhospitable, that it is with considerable difficulty the mines are worked.

In every part of the colony game abounds—deer, hares, pheasants, partridges. The wild animals will soon disappear altogether, the use of strychnine having facilitated their destruction; for no sooner is a leopard or wolf seen than a bait is laid for him, and in a few days his body is found.

In the one forest of the colony, the Knysna, in the George district, elephants still remain in small numbers; but, as the timber of this forest falls under the axe of the colonist, they with the leopards and other wild animals still existing there will soon be exterminated.

During the warm weather snakes abound, and are a great annoyance throughout the colony; but in the cooler months they are rarely seen. Some of them are venomous, the puff-adder the most so, though it is singular how rarely they attack man—never, indeed, except when suddenly disturbed, or in self-defence. Most of them are small. The following interesting account of the mamba snake is by Mr. Layard:—

"Now about snakes. I have never forgotten your quiet, dignified unbelief in my snake histories, and have taken every opportunity of finding out all I can about them; more particularly of the 'mamba' or chasing snake. It is a most vicious creature, and will chase you a mile. You must ride hard if one makes for you. It reaches sixteen or eighteen feet, and has the power of erecting itself on its tail when in pursuit of its object; then throwing itself down and rushing on twenty yards or so, and then rearing up again: and so on, till it comes to some bush or tree, round which it throws its strong tail, and then strikes right and left at its enemies. It seldom bites when on the ground, and oxen pass over it in safety then; but it will strike and face a whole span when erect, throwing itself over on the other side, so as to reach all. The other day, a hunter, who was passing not far from here, killed a small buck under a tree, and sent a Kafir for it, standing quiet to reload—when a dreadful yell arose from the Kafir. A 'mamba' in the tree had struck down on him, but caught at the high crown of hair and wax with which old Kafirs adorn their heads, and the fangs, held by the hair, could not be withdrawn. The hunter raised his gun and shot the beast, which fell from the tree, bearing down the Kafir. Drawing his knife, he severed the hair from the scalp and set the fellow free, without any hurt, leaving the crown in the snake's grasp, which was soon dispatched. This shows their vicious propensities; they will not have their haunts invaded; but, fortunately, they remain a long time in one spot, and when once a place is suspected it is most carefully avoided."

The result of the prosperity of the colony to which I have directed your attention has been to increase the demand from England and for English manufacturers, in fourteen years—from 1843 to 1857—270 per cent.: a rate of increase which has only been surpassed by one colony, Australia.

The following table is extracted from the Board of Trade returns recently published:—

Exports to Colonies, 1843-47.

Increase.

Ionian Islands	90	per cent.
East Indies	139	,,
Mauritius	157	,,
N. A. Colonies	146	,,
Sierra Leone	172	,,
Cuba	270	,,
Australia	792	,,

But before anything like adequate results can be attained or the advantages offered fully realised, by the colonist or emigrant from the fine climate, soil, and position of this large tract of country, old roads must be improved, new roads made, and in certain districts railroads constructed. The present mode of travelling is so cumbrous and so difficult, and, at times, so dangerous, that personal communication between town and country is confined to cases of necessity only, except along the coast, where it is efficiently maintained by coasting steamers running weekly.

Travelling for pleasure is hardly known to the colony. There are three modes of conveyance. The bullock waggon for families moving, and merchandise, accomplishing 20 miles daily; the private cart, with two or four horses, with which, under favourable circumstances, you may make 30 or 35 miles daily; and the post-cart, a vehicle on two wheels, carrying three passengers, and drawn by two horses, which travels at an average speed, including all stoppages, of seven miles an hour.

The bullock waggon is, in fact, a travelling hotel, carrying beds, provisions, and cooking utensils, in which you are quite independent of any accommodation on the road; the cattle being turned out to graze every evening till the time for starting in the morning.

The private cart, which is a covered taxed cart, also carries a certain quantity of provisions and fodder, as farm houses where a traveller can stop are sometimes too distant for a day's journey; but generally speaking, a traveller arranges his route and distances so as to put up each night at a farm, for, except in the more important towns, no public accommodation can be obtained.

The post-cart is also a taxed cart on two wheels, the body being appropriated to the letters. The passengers sit on it, one by the side of the driver and two behind, without any protection but a slight iron hand-rail at the side. They have nothing to lean against, nor anything in front, and only a very narrow foot-board—just broad enough for the feet to rest upon, and in many places where the roads are bad, and water-courses have to be crossed, it is with the greatest difficulty and only by great exertion the traveller can retain his seat.

The roughness, recklessness, and boldness, and yet the skill with which these carts are driven by night and day, where tracks or roads exist, and where there is neither track nor road, whilst it often tries the traveller's courage, and sorely tries his muscles, excites his surprise at the docility and courage of the horses, and the apparent certainty with which in the darkest night the Hottentot driver will pick his way through watercourses or over open downs, and carry you safely to the journey's end. It requires a man in very robust health, and as active as strong, to accomplish the journey without a stoppage from Cape town to Graham's town, or from the capital of one province to the capital of the other.

4. The next division of my subject is, the Aborigines.

There are four distinct tribes or races in the colony:—The Hottentot, the Bushman, the Fingo, and the Kafir.

The Kafir does not belong to the Cape Colony, properly speaking. They have been imported into it either as prisoners of war, or as emigrants, under government regulations, seeking subsistence during and after the famine caused by the destruction of their corn and cattle, in full reliance upon the prophecies of the Impongo Prophetess.

These people are distributed over the colony in twos or threes, as their labour is required by farmers and others. The men are tall, well-made, able-bodied, apt to learn, but as unused to as untaught in any occupation useful in domestic or even in farming life. They seem born warriors, have great aptitude in learning warlike exercises, and have soon learned the use of the gun.

They have no knowledge even of the most simple forms of domestic manufacture, and their worldly stock consists, besides their cattle and sheep, of assegais, knobsticks, now and then a wooden milk-pail, cut in the rudest manner out of a piece of wood, or made of a small rush so closely plaited as to be water-tight, and their kaross or skin, which is almost their only clothing. Their children run about almost naked. It is difficult to understand how so much intelligence as these people exhibit, when their intellect is at all excited, should coexist with the very rude and unsophisticated manner in which they live.

Yet they have some very curious laws transmitted orally from generation to generation, through their chiefs, and which can be traced back, it is said, for sixteen generations, but these I cannot now enter upon; I will only say that the origin of the laws of the Kafir tribes is well worthy of the study of the ethnologist.

The Fingoes were originally a tribe in complete subjection to the Kafirs, from whom we have liberated them. They are a fine hardy race of men, and are employed in all the laborious work of the Eastern Province.

The Bushmen I have already referred to. Believed at one time to be irreclaimable savages, they were almost unmolested in the more northern provinces of Namaqualand. They are now to be found on farms in different occupations, though they are not much relied upon, and are famous for their love of savage life, preferring rather to live by theft than by industry. They are constantly being taken up and punished for sheepstealing, and other forms of farm robbery.

Then the Hottentots, the race more peculiarly belonging to the colony, are regularly employed in all descriptions of labour. The post-cart drivers are mostly Totties, as they are called, and rough and reckless enough they are, though, when required, they show boldness, activity, intelligence, and skill, in overcoming difficulties beyond what we should expect from them.

In the neighbourhood of the towns in the Eastern Province there are separate localities for the Fingos and Hottentots, apart from the white population, and there is as well marked a line of separation between the Fingo and Hottentot as between them and the whites. This is strikingly exhibited at Port Elizabeth and Graham's Town.

Looking, then, at what these races were but a few years back, at the great exertions now being made to improve them, at the demand there is for their labour, and to the example which is constantly before them of our habits and civilisation, which in many little matters they are imitating, there is no reason to doubt that, in a few years, although their colour cannot be changed, they will become a most useful body of people, will gradually become Christian, and form an integral part of the population, which I believe is destined to become important in itself, and of the greatest service to this country.

I could say much more to show the importance of our trade with the Cape in promoting negro civilisation, but time will not permit me. I will therefore only add that, whilst our commerce is advancing so rapidly in the southern and south-eastern coasts, and also in the western coast, France is colonising the north, and Turkey is improving the north-western portions of this great continent; so that we may hope a brighter time is looming in the distance for Africa, and that the white man, in whom rests the sin of having held in bondage, and cruelly used so many millions of Africa's sons, appears now to be the instrument appointed by Providence to promote and secure her regeneration.

I have now arrived at the last division of my subject.

5. The advantages this colony offers to emigrants, first in their relation to the mother country, and then to their own prosperity.

Everything in the colony is checked for want of labour, and the question has arisen how best to obtain it. The first attempt on a large scale has not proved successful. The German legion did not make good and useful emigrants; neither men nor women were of the right sort.

Then Sir George Grey made a contract with a German house for the importation of several thousand German emigrants, which contract has not been approved, and wisely so, I think, by the Home Government; and now the Colonial Parliament has voted £80,000 to assist the emigration of persons of good character from England, which appears likely to produce the best results. It appears to me to have been a great mistake of the Governor to attempt to introduce another foreign element into the colony. There are already languages enough spoken; and the great object ought now to be to consolidate the English interests in the colony.

The arrangements made by the colonial government for the conveyance of these emigrants are of the best description. The entire management is under the control of Mr. Field, the emigration commissioner; and from conversation with emigrants, on their arrival at Table Bay and Algoa Bay, I can state that all have been pleased and satisfied with the arrangements made for their comfort during the voyage.

On arrival, they are equally well provided for, and all classes appear to receive them kindly and to endeavour to promote their interests by assisting them to obtain employment. From the moment occupation is found, the emigrant must rely exclusively on his own exertions and prudence.

He must consider the colony as his home. The climate and soil secure to him a most ample return for his industry; the salubrity of the air, its genial temperature during the greater part of the year, ensures the greatest possible amount of enjoyment for the smallest expenditure on what are here considered the necessaries of life.

The number of days in the year during which all out-door work can be pursued is very large; and, I believe, it will be found that in no other colony is the return for industry employed in agriculture more certain or more remunerative; a very small piece of land, properly worked, will yield a supply of fruit and vegetables all the year for a family.

At present the demand for skilled labour—for artizans—better workmen than Malays, is great; as it is also, for domestic servants. And, with the impetus now given to public works, this must, I believe, continue for years to come. But only really skilful workmen will realise high wages, for inferior hands will always have to compete with Malay labour, which will be given at a rate below that which an emigrant would like to submit to; but to those who are willing to work, husbanding their resources till they have had some experience of the people and country, depositing what small means they have in one of the banks, either of which will allow interest at the rate of six per cent. per annum for it, and accepting immediately they arrive any employment they can meet with, this colony offers great advantages.

Then, again, the certainty and regularity of communication with England is of importance to an emigrant. The mails sail monthly, very rarely exceeding 38 days on the voyage, and this frequency and duration of the voyage will, no doubt, be improved during the next few years as much as the present facilities exceed those of a few years past.

There is, however, no gold here to tempt an emigrant; but if that be wanting, he will find a most hospitable reception by all classes in a beautiful and healthful climate, an ease of living, a productive soil, and a civilised and a well-ordered government, each of which is almost equal to gold diggings, but when united, form to an English emigrant family—man and woman, son and daughter, greater security in prosperity, greater personal safety, greater certainty of happiness, greater intellectual, political, moral, and religious liberty, and an earlier and richer enjoyment of all that makes life valuable than can be found in colonies where gold abounds, but where the too easy and too rapid attainment of that precious metal has been often purchased by a large sacrifice of all those principles which make its possession valuable and beneficial to an emigrant and his family.

DISCUSSION.

The Chairman said he was sure they all felt greatly indebted to Mr. Hawes for the very interesting statement that he had laid before them, which had the additional advantage of coming from the testimony of an eye-witness, Mr. Hawes having himself visited the colony.

Mr. P. L. Simmonds said, limited as Mr. Hawes was for time, he was necessarily obliged to notice some subjects very briefly, and to pass over many others altogether. He (Mr. Simmonds) would therefore make a few observations upon those subjects which seemed to demand a little more prominent notice. From its peculiar position the Cape Colony was the half-way house and halting place for many hundreds of ships and steamers from numerous quarters. Including coasters, the entries and clearances in the year numbered about 2,000 vessels, registering from 600,000 to 700,000 tons. The Cape was already the centre of a large and rapidly-increasing commerce with Australia, India, the Mauritius, Ceylon, Brazil, America, and Europe. She enjoyed a monthly steam communication with England, but it was proposed to make this bi-monthly by extending a steam line from the Colony to the Mauritius, so as to connect it with the communication *viâ* Suez, for which a vote of £12,000 had been sanctioned by the Colony. The Colony now owned 56 ships, registering 7,831 tons, of which 43 were above 50 tons, and by the last advices the launch of a colonial-built vessel, of 200 tons, was recorded. Mr. Hawes had drawn a comparison between Cape progress and Australian progress, but he had scarcely made the most of the figures. Without any invidious feeling he (Mr. Simmonds) might call attention to the returns. For instance, taking Victoria, once the most important of our pastoral colonies, and ranking above all others in the number of its live stock and the extent of its wool shipments, either from the distraction of the goldfields, or the slaughter to supply the increased population with meat, the want of shepherds, or some other cause, Victoria was gradually declining in sheep, and the Cape was outstripping it. Taking the Cape returns, cited by Mr. Hawes, for 1855, and comparing them with the returns for Victoria in the early part of last year, he found that the Australian colony had only 55,683 horses, or, but half the number in the Cape; and only 4,766,022 sheep, against 6,500,000 in the Cape colony. Victoria had, indeed, a larger number of cattle (614,537 head), but these were not all bred within the colony, many being drawn from the neighbouring colonies. In the matter of cereal crops, the Cape had 20,000 or 30,000 acres more under culture with grain than Victoria—a very important point as evidencing agricultural progress—and which had led to its being able to export flour and grain, instead of being obliged to import, as Port Philip was, bread stuffs largely. It was to be hoped that this flood-tide of progress, which had been alluded to, was an earnest of permanent future prosperity. The value of the exports from the Cape had trebled in the last three years, and her wool shipments now exceeded those of Victoria; with an increased supply of labour, and the aid derived by the Dutch extension of pasturage, sheep farming seemed likely to spread most rapidly. In the wool circular of a leading firm, it was observed recently of Cape wools:—

> "This description continues to gain in public estimation, and these colonies are evidently destined to take a high position from their peculiar adaptability for the growth of fine wools, particularly of fair, useful qualities; and the extent to which it may be carried seems almost without limit."

It was satisfactory, also, to notice that the sheep-farmers were beginning to abandon the suicidal policy of shearing their sheep twice a year, instead of allowing the wool to attain a full growth, because this short staple wool had hitherto materially injured the general character of the Cape wools, as being unfitted for many manufacturing purposes. Much had lately been done to improve the breeds by introducing Saxony rams, Merinos, Cheviots, the beautiful French breeds, and others suited to particular localities and pasturages. The Angora goat, and other useful animals, had also been introduced; and, while they were studying to improve the fleece, they were not neglecting the carcase, but testing Southdowns and others which could contribute meat suited to the growing wants of an increasing population. The extensive shipment of horses to India had been alluded to by Mr. Hawes, and this was but the beginning of a very extensive trade, for which the Cape possessed many peculiar advantages over Australia. Not very many years ago, the Cape colonists were obliged to import horses and mules from South America; now they were able to spare large numbers for India. It had been suggested that the Cape might be made with advantage a military depôt for the training of recruits, who, by a short service on the border provinces, would not only be useful to the colonists, but would become acclimatised and better fitted for removal to India. The Cape farmers of late years had suffered severely from two great calamities, which made sad ravages among their stock,—the horse sickness and the lung disease, or pleuropneumonia. In the year 1855 the losses thus incurred amounted to £500,000, carrying off about 65,000 horses and 95,000 head of cattle in the year. The latter epidemic was not confined to the Cape, but had been a fearful scourge in Europe and other quarters for some time past, and he was induced to allude to it from seeing in the last Cape papers the mention made of a local plant said to be a sure cure for the lung disease. As it was spoken favourably of after several trials, it might, at least, be worth further inquiry. The plant was stated to have a common weed-like appearance, bearing a striking resemblance to wormwood, and was found plentifully growing on the banks of the Buffalo River. It was known by the natives as "Bohlungu" (the poison herb). The following was the recipe and mode of administering it:—

> "Six ounces of the plant cut up small, and boiled for two hours in three quarts of water, to which add a quarter of a pound of yellow soap; after which strain the mixture; one ounce of gunpowder is to be then added to each quart of the mixture, which, after being dissolved and well shaken, is to be

> administered to the animal (standing) in doses of one and a half to two quarts, as soon as the first symptoms of the disease shew themselves."

Among our other debts to the Cape Colony, we had received from thence, and successfully acclimatised, a large and valuable animal—the eland, which, Professor Owen, in a recent letter informed him, furnished, as he had anticipated, excellent meat when fatted for the table. Ten years ago he (Mr. Simmonds) had called attention, in his "Colonial Magazine," to the desirability of introducing this animal and any of the antelope tribe for propagation and diffusion at home and abroad, so that they might not altogether be exterminated by the progress of colonisation. Another Cape product, making headway even against many prejudices, was the wine of the Colony, which, though much sneered at in certain quarters, was yet evidently esteemed by many in preference to the cheap and vile "manufactured" ports and sherries. He held in his hand a circular from a large wine house, from which it appeared that the Cape wines now ranked third in quantity in the total imports, duty having been paid last year on 726,314 gallons, of which 427,848 were taken in London. The circular further stated:—

> "The purity of these wines is no longer a question of doubt, as we are supplying large quantities to nearly all the hospitals and restorative institutions, and the highest medical authorities are recommending them on account of their extreme freedom from acidity, and because, by the Custom House law, they contain less spirit than is allowed in all foreign wines."

The extension of road communication, the introduction of railways, and the improvement of harbours, would naturally facilitate transport, and there was no knowing what might even be done in inland navigation in the far interior before long. The steamer was now on the Orange river, the Zambesi, and the Niger, and looking at the immense advantages which had accrued to Australia by the navigation, for thousands of miles, of the Murray river and its tributaries, formerly considered impassable, there was a hopeful future in store for the Cape Colony and the border states. The great difficulty that pressed at present upon the Cape was the insufficiency of labour, for, notwithstanding the liberal colonial grant made a couple of years ago for this purpose, and the appointment of special resident commissioners here, only 1,700 emigrants had been obtained. Whether this arose from the present ease and comfort of the bulk of the working population here, or from any objection to the Colony, he could not say, but besides the demand for agricultural labour great public works in the colony were at a standstill. A grant of £20,000, voted for building and repairing prisons, could not be drawn, because there was no labour to execute it. It was true that there were now within the boundaries of the colony 100,000 independent Kafirs, but these were unskilled and indolent—a burden, and a trouble to the colony. In the Eastern Province they outnumbered the other classes, white and coloured, by about 4,000 souls, and as they could not be advantageously employed, it was under discussion whether some of them might not be sent to the Mauritius, where this class of labour was in demand. There was one other matter he would advert to before he sat down, and that was the expediency of consolidating more firmly our South African dependencies, by a federation of the whole, comprising also the present independent states. There was a strong growing feeling in favour of this federative principle, not only at the Cape, but in British North America and Australia; and, though there might be some difficulties in the way of carrying it out, its adoption would lead to very beneficial results in giving union, strength, and greater identity of interest. He had always regretted the impolitic step which had been taken of throwing off the British sovereignty from the Orange River States, and suffering several independent Dutch States to exist on our borders. Over these we had now no control. We had estranged them from us by many wanton acts of oppression, neglect, and vacillating policy. The border feuds and forays which the Dutch boers carried on with the Kafir tribes, would inevitably lead to continual disturbances. At all events, the statements furnished by Mr. Hawes clearly proved that the Cape Colony was not one that ought to be abandoned or lightly regarded, even if, through former misgovernment, it had been an expense to the mother country. Peace now reigned within and without her confines. The colony was teeming with intrinsic wealth, and its leading staple was in great demand at remunerative prices, and was yearly increasing. General prosperity had supplanted a period of pressure, and, notwithstanding the withdrawal of the large number of troops for India, the expenditure on whom had diffused a large sum of money in the colony, the present and future prospects of the Cape were now brighter than they had been for many years past.

Mr. E. W. **Trent** regarded the subject of the supply of fibres from our colonies as one of the greatest importance. He had seen a specimen of fibre which had been sent to the Secretary of the Colonial Fibre Company, which was equal to the celebrated Italian hemp, which was selling at £70 per ton in the London market, or more than double the price of the best Russian hemp. The sample to which he alluded was so nearly equal to the Italian hemp that he could scarcely tell the difference between the two. During the war with Russia, the question of the supply of hemp for rope-making purposes became one of considerable importance, and suggestions were made as to the probable quarters from which it could be obtained, and various samples of hemp and flax were manufactured and tested as against the Russian material. Mr. Trent proceeded to mention the results of these experiments. Rope made of Irish hemp broke at a strain of three tons; the Russian at 3 tons 3 cwt.; whilst rope of the same number of strands made of Italian hemp only broke at a strain of 5 tons several cwt. He thought if the cultivation of fibres were attended to, with the introduction of good machinery for their manufacture, it would form a most important feature in the resources of the Cape Colony. Upon the subject of emigration, he would remark that, having spent the whole of the summer in the provinces of Canada, both Upper and Lower, and having conversed with many members of the legislature there, and others, upon the subject of emigration, he found that the conclusion arrived at was that almost nine out of every ten persons who emigrated to that country were not suited to the wants of the colony. His own observation throughout the various districts of Canada tended to confirm that conclusion. What they wanted in their colonies was younger men, who had received some sort of education and training that would fit them to become good colonists.

Mr. J. G. **Frith** entirely concurred with all that Mr. Hawes had laid before them on this interesting and important subject. He, however, regretted that no greater stress had been laid on the value of the horses of the Cape, which were indeed most remarkable animals. In the matter of improving the breed of horses in that colony, they were very greatly indebted to Lord Charles Somerset. Their size, docility, and powers of endurance were very extraordinary, and altogether they excelled the horses of any other country, except those of England. They might go into a stable of 50 entire horses at night, the animals being unhaltered, and receive no injury from them, such was their remarkable docility.

Mr. R. A. **Slaney**, M.P., congratulated the Society upon this most able paper, descriptive of one of our most prosperous colonies; of which it was pleasing to think that England possessed so many. If they took, first the Canadas, and considered the vast increase there, both in population and importance, and then came to the splendid colony of which they had heard so excellent a description that evening, or if they advanced to the Australian colonies, with their enormous natural riches and resources, they saw open before them a vast field for energetic colonization, throughout those immense countries, carrying with it, he trusted, the freedom and constitution which distinguished our own land. It was very gratifying to hear that the exports from our colonies, of articles valuable to the mother country, had so largely and rapidly increased. They gave us in the first place that valuable raw material, wool, which supplied a manufacture, formerly the first in this country, and now only second in importance to cotton, the manufacture of which excelled anything the world had ever seen. He wished to ask the question, whether there were not in this vast colony any animals or birds that might be brought to this country, and become gradually introduced for domestication, so as to be useful and ornamental? A large proportion of our poultry had originally come from the east. The guinea fowl and the turkey, were foreign importations, and he hoped the time would not be far distant when they might introduce valuable birds and quadrupeds from these colonies. He had suggested to the Zoological Society, that they should make attempts to reintroduce into this country, in a domestic state, one noble bird, which had become almost extinct within our own time—he alluded to the bustard. The efforts to do so had, however, not hitherto been successful; but he thought under more favourable circumstances this might be accomplished.

Mr. Irons, as a colonist, could bear testimony to the value of the information which Mr. Hawes had afforded them that evening. He was glad to see so much interest taken in the Cape Colony by the members of the Society of Arts, and he felt sure that much good would result from the spread of the knowledge of colonial questions which that evening's discussion tended to promote. He desired to express his high sense of the value of the services rendered by Mr. Field, the Emigration Commissioner, to whom the colony was deeply indebted.

Mr. S. Sidney said although he still took a warm interest in the subject of colonisation, he no longer took any active part in it. Therefore, what he should say would rather have reference to the experience he had gained in the past, than contribute any information as to the present state of the colony now under consideration. He had been much struck with the temperate and practical tone which had pervaded the whole of this discussion, affording a strong contrast to the way in which these matters were treated some 12 or 14 years ago, when he (Mr. Sidney) took an active part in colonial emigration. The subject of colonisation was then taken up by half-a-dozen different societies, with rival interests to support, and exaggerated pictures were drawn of the advantages of one colony to the prejudice of another. Mr. Hawes, however, had not endeavoured to incite emigration to the Cape with the view to subserve any particular interest, but he had treated the subject upon the broad principles of general good. He had not extolled the productions of the Cape as rivalling or excelling those of other countries. He had not placed the furniture woods of the Cape in rivalry with those of Honduras or Brazil; nor had he brought the dye woods to vie with those of India; but he had presented an unadorned picture of the resources of the colony, which might be developed by taking advantage of its soil, climate, and natural capabilities. Let them for a moment contrast the past history of the Cape with its present condition. It was obtained by conquest, and was then regarded as a second Gibraltar—as a fortress to protect our ships on the road to India; and it would not do for financial reformers of the present day to take pains to calculate what the Cape had cost us. There had no doubt been much misgovernment for a long series of years, but happily those days were past, never to return. The Colony was now flourishing under a little healthy neglect, and being managed by the colonists themselves we might look forward to a vast development of its resources. The staple production of the colony being wool, which was just one of those commodities which it was formerly thought a wise policy to load with heavy taxes, foreign and colonial wool being regarded as competing with our own; but since the imposts upon that article had been removed, wool had become a constantly and rapidly increasing production in our colonies. The next important production of the colony—wine, had been so ably treated of by Mr. Simmonds, that it was unnecessary to say more with regard to it. With respect to horses, all were aware that our operations in India were nearly brought to a stand-still for the want of them, and he regretted to find the mistake that had been made owing to the recommendation of the representatives of the Indian government to the Cape people to improve the breed of the horses by means of the half-bred horses of this country, instead of the thorough-bred and steeple-chase horses. Important as wool and horses were, however, the great question was that of emigration. No doubt every colony was desirous of getting the best mechanics, the best farm labourers, and the best servants, but if the colonists required such a high standard of excellence in their emigrants, they would have no chance of getting the required supply. England, with all her shortcomings, was a remarkably good country to live in, and the working classes generally found it to be so. The first great movement made in stimulating emigration, was by those who told them that emigration was one of the lost arts, and that they were going to re-establish it; the means being to send out only young healthy couples to the colonies. No old fathers and mothers were to be encouraged to emigrate, and grandmothers, uncles, and aunts they would not hear of. They tried the system and it failed, as might have been expected. The attraction of gold in Australia had been spoken of, but whatever didactic speeches they might make against it, people would always run after gold. The plan of emigration which he, Mr. Sidney, had had the honour of assisting that estimable lady, Mrs. Chisholm, to carry out, had been most successful. Emigration was much promoted by facilities for postal communications between friends in one country and the other; by facilities also for the transmission of money from the colonies to this country, to assist the families of the settlers in forming family groups; and he believed cheap postage and ready means of communication would do more than anything else in promoting emigration to our more flourishing colonies. He begged to thank Mr. Hawes for the pleasure which his paper had afforded him, and for giving them information which would enable them to start from a new point. Let them forget the unfortunate past of the Cape. They might now look upon it as a self-supporting colony, and with English settlers alone, without a larger infusion of the foreign element, it might look forward to taking a foremost place amongst the numerous important colonies of England.

Mr. Hyde Clarke said that, having many relatives and connexions in the Cape colonies, and having long taken a deep interest in their welfare, he had listened with earnest attention to the valuable paper of Mr. Hawes. The value of that paper consisted in its making known to the public in a marked manner the great change which had, within a very few years, taken place in the Cape colonies since the working of Parliamentary Government. He had considered the public were not sufficiently aware of this great change for the better, and he had witnessed with satisfaction the efforts of Mr. W. J. Irons for making known the resources of the colony, and had urged on Mr. Algar the establishment of the *Cape and Natal News*, as a step well calculated to keep the colonies before the public. He did not know whether Mr. Hawes included Natal within the limits of his subject, but that country was important in connexion with the other Cape colonies. The result of Parliamentary Government was not so much to be sought in legislative action, or even in public works, as in the general energy of associative action which had resulted from free institutions. This was shown, not only by the number of new institutions for education, but by the numerous joint-stock enterprises, of which more had been carried out within the last few years than from the very beginning of the colony. While he admitted the great progress of the Cape, he could not concur with Mr. Hawes or Mr. Simmonds in the full extent of the comparisons they had instituted. They should never forget that the capital introduced by immigrants was never rightly to be estimated as a part of the commercial imports to be calculated per head; for, whether they looked at the Cape formerly or now, Natal, or Australia, this amount of goods imported by immigrants would be a disturbing element. He did not think it fair to Victoria to take it on the basis of the present population, which had rapidly increased from a small amount, and compare it with the Cape, which, having been longer settled, had likewise a population of more stable character. The contrast between South Africa before the late Parliamentary epoch and its present condition was most remarkable. True it was that formerly new enterprises were opened from time to time, but other branches of enterprise retrograded, and the country went back concurrently. Thus the wine trade had dwindled, the whale fisheries became extinct, shipbuilding had fallen off, the fisheries were discouraged, Natal had been temporarily abandoned, the Orange River totally abandoned, and the Hollanders driven into that most fatal step of forming the anti-English establishment of the Emigrante Gebiet or Transvaal Republic, an institution equally hostile to the old colonists and the aborigines, as well as to missionary civilization. Now the wine trade had revived, trade had been created in copper, sugar, horses, aloes, arrowroot, and various articles, the wool-growing had been improved and extended to Natal; and what was the small village of Port Elizabeth was now the second wool port of the world. Natal had been successfully established; new colonies were extending, and there was every prospect of the Orange River rejoining the South African federation. With regard to the Karoos and other deserts, a great change would take place in the country by the establishment of railways, which would enable them to be crossed, and by the introduction of camels. As to the alpaca, he was glad to find that the efforts he had made for its introduction were useless, as Mr. Henry White, of Swellendam, a zealous friend of the colony, had already succeeded. The planting of trees was a most important matter; he would strongly recommend that, as in South America, trees should be planted along the rivers, under the direction of the Government. He hoped they would profit further by Mr. Hawes's paper, in the valuable lesson it taught of applying the same principles of free associative action in our other colonial associations, more particularly to India. The Chairman, Mr. Ewart, who in the last session had been so successful in the settlement of the question of Indian colonisation, and to whose efforts we were indebted for obtaining from Lord Stanley a fee-simple tenure of land in India, and the free disposal of waste lands, would have additional arguments from the experience of the Cape, in demanding for India good municipal institutions, the free action of enterprise, and the establishment of efficient railway transit. He must again remind the members that the Society of Arts was the only institution in London where colonial interests could be represented. We had been greatly indebted to it for the promotion of Indian colonisation, and he was sure that Mr. Hawes was not only entitled to their thanks, but that he had rendered a most important service to the South African colonies.

Mr. **Hawes** would detain them with very few observations in reply to the remarks that had been made. In the first place he would say that his great difficulty had been to bring within the compass of an hour the various matters of interest connected with the colony, and he feared he had, in some instances, too much condensed his observations to make them intelligible even to such an audience as had honoured him with their attention that evening. With regard to local shipping at present, it was very small, but every year it was increasing, and the horses sent out to India were conveyed in fifty vessels, chartered by Cape merchants on the spur of the moment. Mr. Slaney had inquired as to the probability of our stock of domestic animals and birds being increased by importations from the Cape. He could not say he had any hopes in that direction; he rather thought the attention of the colonists would be better devoted to the improvements of their breeds of cattle and poultry imported from this country. Mr. Hyde Clarke had said that his (Mr. Hawes's) returns were taken too favourably for the Cape compared with Victoria, because no allowance had been made for the property brought into it by immigrants. This, however, told against the Cape and in favour of Australia, because the amount of emigration to the latter was so very much larger than to the former, there having been no emigration to the Cape till last year, of which year there were no returns.

The **Chairman** said, at the hour to which the discussion had extended he could not occupy them with any remarks of his own upon the interesting subject which Mr. Hawes had brought before them, although, had time permitted, there were one or two points to which he could have wished to have alluded. He could not, however, allow the proceedings to close without complimenting Mr. Hawes upon the vast amount of valuable information he had compressed into his paper, and he was sure he should carry the feeling of the meeting with him in proposing a cordial vote of thanks to that gentleman for his paper.

A vote of thanks was then passed to Mr. Hawes.

Professor **Tennant** exhibited a case of minerals and fossils illustrating some of the geological features of the country, consisting, amongst others, of the *Dicynodon*, (Owen). In 1844 Professor Andrew G. Bain discovered in the tract of country extending northwards from the county of Albany, about 450 miles east of Cape Town, several nodules or lumps of an argillaceous clay ironstone, which, when broken, displayed fossil bones, mostly of a skull with two large projecting teeth. Mr. Bain gave to them the name of "Bidentals." They were transmitted to England, and carefully examined by Professor Owen, who found them presenting in the construction of their skulls characters of the crocodile, the tortoise, and the lizard, coupled with the presence of a pair of large, sharp-pointed tusks, growing downwards, one from each side of the upper jaw, like the tusks of the mammalian morse or walrus. No other kind of teeth were developed in these singular animals.* Also specimens of copper ore from Port Elizabeth, and a beautiful mineral, used as a gem, sometimes called brown "cat's eye;" the correct name, Krokydolite, from Orange River.

The Secretary announced that, on Wednesday next, the 16th inst., a paper by Professor Leone Levi, "On Trade Marks," would be read. On this evening Sir Richard Bethell, M.P., will preside.

SALE OF CORN BY WEIGHT.

The following document has recently been circulated, signed by ninety-eight persons engaged in the Corn trade:—

Liverpool, 11th February, 1859.

"The undersigned merchants, factors, dealers, and brokers, engaged in the corn trade, in Liverpool, having heard with regret that at Glasgow and elsewhere the 'Cental' has not been received with that unanimity which was generally anticipated, desire to express their entire approval of the new weight.

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* A full description will be found in Trans: Geological Society, 2nd Series, Vol. VII. See also Vol. XV., Part I., of Encyclopædia Britannica, (being the last Vol. published,) under the article "Palæontology," by Professor Owen.

"Since the 1st of February the undersigned have bought and sold by the 'Cental,' and they see no reason whatever to doubt that the new system will confer upon the trade and the public, the advantages promised for it.

"The simplicity of the 'Cental' becomes every day more and more evident, and the undersigned, though they observe occasional instances of perplexity among those who are suddenly called upon to use the new weight in lieu of the old one, are strongly persuaded that few changes of so beneficial a character have ever been made with less real inconvenience, and the undersigned are satisfied that all that is required is a little perseverance, when the difficulties attending the introduction of the change will gradually disappear."

Home Correspondence.

PRODUCTS OF THE COMBUSTION OF COAL-GAS.

Sir,—A letter from Mr. F. J. Evans in yesterday's *Journal of the Society of Arts*, states that the formation of oil of vitriol (sulphuric acid), during the combustion of coal-gas in the ordinary way is impossible.

I have seen sulphuric acid so produced, hanging in drops from the bell-glass over the burner, and so concentrated as to destroy linen on which it had dropped.

I am, &c.,
H. TAYLOR.

5th March, 1859.

ON COLOURING STATUES.

Sir,—I had hoped to have been present at Professor Westmacott's reading, on Wednesday last, and to have produced at the meeting two specimens of image painting—statuettes, neither of them, perhaps, of the highest art, yet sufficient to illustrate the argument of how these matters should be treated with colour. One was a porcelain Shepherd, bedaubed with red, yellow, and blue, being intended for the decoration of the homes of the humbler classes; the other a "Bergerette," of the Wattean School, in Dresden china, painted in the most delicate manner; a pleasing object, certainly improved by colour, and an ornament worthy of the most elegant boudoir.

The one was glazy, ugly, and coarse; the other delicately soft and sweet, perhaps maudlin in sentiment, but yet enough to show that isolated specimens of refined or classic sculpture ought never to be painted in primitive colours, but rather be tinted or stained, so as to permit of the texture and transparency of the stone being seen. Indeed, in wholly nude or heroic figures, the pure untouched material ought to suffice, any aid tending to sensualise, destroying that lofty conventional tone so essential to the highest works of art.

Of figures, either upon pediments or otherwise, in connection with architecture, it is somewhat different: in the classic, tinted backgrounds may aid outlines, and in later styles positive colours be used with great effect, as numerous painted altars and tombs will testify—then rather in juxtaposition with the picturesque or irregular than the simple and severe.

That the English school of sculpture—like that of painting—should become remarkable for its colour, is not, I think, to be desired, as it would decidedly tend to destroy the little appreciation of form it has. I do not say that in isolated cases slight colour may not aid, but there are many in which it would deteriorate, as may be seen by the figures over the windows of St. James's-hall (Mr. Owen Jones's effective interior), where both from size and tinting the poor individuals elevated there look like specimens of impaled humanity, *sans couverture*. Of the attempt to colour the Panathenaic Frieze, all who run to Sydenham may read about the degradation of the divine work of Phidias, and learn what to touch and what to avoid. Certainly the great works of the antique artists, having beauties of their own totally independent of place or time, never stood in need of a coat of paint—the very idea of the *Laocoon* or the *Farnese Hercules* painted or tinted being simply comic.

I am, &c.,
JOHN LEIGHTON.

LOCAL ASSESSMENT BILL.

Sir,—It may be interesting to some of your readers, and also useful in reference to the battle to be fought on the 25th instant, to give a short account of the history of this Bill. It will enable the Institutions which claim to be left alone to urge their claim with an argument they might not otherwise possess.

This Bill is the result of well-founded complaints from Portsmouth, Devonport, Gosport, Greenwich, Deptford, Woolwich, and Chatham, that the great naval and military establishments in their respective parishes, and placed there for the benefit of the nation and not of the parishes, are exempted from the charge of poor rates, and consequently, that the rates charged on the occupiers of the other properties are very considerably increased. These complaints were investigated by a Select Committee of the House of Commons last session. Witnesses from each of the towns I have mentioned were examined, and made out a strong case for the abolition of the exemption of the national establishments referred to. No complaint was made of the exemption of Scientific and Literary Societies. They are referred to in the evidence of Mr. Lumley, the Assistant Secretary to the Poor Law Board, who was examined to explain the law and practice of assessing property to poor-rates, and to describe the exemptions which exist. He expressed no opinion as to the exemption of our Societies, but simply stated the provisions of the statute relating to them, and the extent of its operation. Not a single witness uttered a complaint of this statute or gave any evidence respecting it. The town clerk of Devonport was asked whether the principle which he wished to apply to dockyards, powder works, fortifications, and barracks, should not be applied to gaols and town-halls, hospitals and charitable institutions; and in his replies he drew this distinction, "where buildings are locally situate in a small community, but exist for the benefit of the whole, it is an injustice to that small community that they should be taxed for the benefit of the whole; but, where a building is erected in a parish for the purposes of the parish, there would be no object in rating it, because the parties who are interested, and the parties who pay the rates are identical."

Now this is our case; our Mechanics' Institutes exist for the benefit of the community amongst whom they are placed; not only the members, but the whole district is benefited; therefore it is felt by the ratepayers to be just that they should bear an increase in their rates for the sake of increasing the means of usefulness of these Institutions.

In addition to the witnesses I have referred to, there were witnesses from Liverpool and two parishes in London, in reference to Dock dues and Corporation buildings, Somerset-house, and St. George's Charities, Southwark. Their evidence did not refer to the Societies' Act, 6th and 7th Vict., c. 36.

Notwithstanding the absence of all evidence in reference to any injurious operation of this statute, or of the exemption always enjoyed by hospitals for the sick poor, the committee recommended "that all land and buildings used and occupied for public, charitable, scholastic, or scientific purposes, whether there be a beneficial occupation or not, except buildings occupied by the

Sovereign, or as churches or chapels, burial grounds, toll houses, highways, and public bridges, should be assessed to local rates." The bill adopts this recommendation, and, if not amended, the buildings of all Scientific and Literary Societies, and also of all Charitable Institutions, will become chargeable to poor-rates and other local rates.

Let every Society and Institution so threatened make common cause, and, before the 25th inst., form a monster deputation to Lord Derby, and we must succeed in cutting down the Government Bill to its just proportions. Let it grant the remedy demanded by the evidence, but let it not interfere with those important local bodies respecting which there has been no inquiry, and against whose exemption there has been no complaint.

I am, &c.,
ARTHUR RYLAND.

Birmingham.

P.S.—I shall be happy to send a form of petition to any Society desiring one, and to receive the names of those Societies who would be willing to appoint delegates to attend a Conference at Fendall's Hotel, Westminster, on Wednesday, the 23rd of March, at 12 o'clock.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Rev. Henry Christmas, "On Shakspeare's Historical Dramas."
Medical, 8.
Geographical, 8½. I. "Explorations in South Australia, by Messrs. Babbage, Warburton, Stuart, &c.," communicated by the Right Hon. Sir E. Bulwer Lytton, Bart. II. "Notes on the Manacousi, or King George River, S.E. Africa," by Chas. Helliard, Mate of the Cutter "Herald," communicated by Consul Lyons McLeod.

Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. I. Mr. T. F. Chappe, "An Account of Experiments made upon Elliptical Cast Iron Arches, with a view of ascertaining the safe load to which they may be subjected." II. Mr. Matthew B. Jackson, "Description of the Melbourne Gravitation Waterworks."
Statistical, (Anniversary, 3) 8. Mr. L. E. Greenhone, "On the Standard Rate of Mortality."
Pathological, 8.

Wed. ......London Inst., 7. Conversazione.
Society of Arts, 8 Prof. Leone Levi, "On Trade Marks."
Ethnological, 8½.

Thurs. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Royal Soc. Club, 6.
Antiquaries, 8.
Linnæan, 8.
Chemical, 8.
Royal, 8½.

Fri.........United Service Inst., 3. Lieut.-Col. Hamley, R.A., "Frederick the Great's Campaign in 1757."
Royal Inst., Meeting, 8. Lecture 9. Rev. Walter Mitchell, "On a New Method of rendering Visible to the Eye some of the more Abstruse Problems of Crystallography, hitherto considered only as Mathematical Abstractions."

Sat. ......Asiatic, 2.
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."
London Inst., 3. Mr. Thomas A. Malone, "On the Metallic Elements, and their Principal Salts and Alloys."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 25th February, 1859.

72. East India (Revenue)—Copy of Letter, dated 31 Dec., 1858.
73. ,, ,, (Judicial)—Copy of Letter.
74. ,, ,, (Army)—Return.
81. Committee of Election—1st Report.
82. Railway and Canal Bills—1st Report.
85. Mr. G. H. Ryland—Papers and Correspondence, &c.
40. Bills—Evidence by Commission.
41. ,, Church Rates.

Delivered on 26th and 28th February, 1859.

4 (1). Church Rates—Supplemental Return.
68 (1). Trade and Navigation Accounts (31st January, 1859).
84. Weedon Inquiry and Manning the Navy—Royal Warrants.
6. Railway and Canal Bills: (1, Bagenalstown and Wexford Railway; 2, Banff, Macduff, and Turriff Junction Railway; 3, Beckenham and Sydenham Junction Railway; 4, Bedford, Potton and Cambridge Railways; 5, Belfast and County Down Railway; 6, Berks and Hants Extension Railway; 7, Birmingham, Erdington, and Sutton Coldfield Railway; 8, Birmingham, Erdington, and Sutton Coldfield (Western Line) Railway; 9, Bradford, Wakefield, and Leeds Railway; 10, Bridport Railway; 11, Burton upon Trent Railway; 12, Caledonian Railway; 13, Carmarthen and Cardigan Railway; 14, Castle Douglas and Dumfries Railway; 15, Caterham Railway; 16, Central Wales Railway; 17, Cleaveland Railway; 18, Colne Valley and Halstead Railway Extension; 19, Cork and Kinsale Railway; 20, Dartmouth and Torbay Railway; 21, Dublin and Drogheda Railway; 22, Dublin and Wicklow Railway; 23, Dundee and Newtyle Railway; 24, East Kent Railway; 25, East Suffolk Railway; 26, Epping Railways; 27, Formartine and Buchan Railway; 28, Great Northern Railway; 29, Great Northern and Western (of Ireland) Railway; 30, Great Western and Brentford Railway; 31, Hampstead Junction Railway; 32, Herne Bay and Faversham Railway (Margate Extension); 33, Hertford, Luton, and Dunstable Railway; 34, Hooton and Neston Railway; 35, Kensington Station and North and South London Junction Railway; 36, Kingsbridge and South Devon Railway; 37, Lancashire and Yorkshire Railway (Ossett and Dewsbury Branches); 38, Lancashire and Yorkshire Railway (Rochdale and Royton Branches); 39, Leatherhead and Dorking Railway (No. 1); 40, Leeds, Bradford, and Halifax Junction Railway; 41, Leominster and Kington Railway; 42, Llanidloes and Newtown Railway; 43, London and North Western Railway (Batley to Adwalton); 44, London and North Western Railway (Denton to Stalybridge); 45, London and North Western Railway (Extension to Ossett, &c.); 46, London, Brighton, and South Coast Railway; 47, Lymington Railway; 48, Manchester, Liverpool, Swansea, and Milford Haven Junction Railway; 49, Manchester, Sheffield, and Lincolnshire Railway (Station at Manchester); 50, Maybole and Girvan Railway; 51, Merthyr, Tredegar, and Abergavenny Railway; 52, Mid Kent Railway; 53, Midland Railway; 54, Midland Great Western Railway of Ireland (Liffey Branch, &c.); 55, Mid Sussex and Midhurst Junction Railway; 56, Much Wenlock and Severn Junction Railway; 57, Newry and Armagh Railway; 58, North British and Selkirk and Galashiels Railway; 59, North Eastern and Bedale and Leyburn Railway (Amalgamation); 60, North Eastern Railway (Harrogate Branch); 61, North Eastern Railway (Nidd Valley Branch); 62, North Western Railway.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 4, 1859.]

Dated 18th December, 1858.

2898. I. Ketchum, 59, Canning-street, Liverpool—Imp. in the method of roasting meat, poultry, game, by basting the same, and in the method of manufacturing the necessary apparatus for so doing.

Dated 22nd January, 1859.

200. L. A. Drouin, 95, Rue Popincourt, Paris—Imp. in covering joinery work with metals or metallic alloys, and apparatus for the purpose.

Dated 29th January, 1859.

270. J. J. A. de Bronac and A. J. M. Deherrypon, Paris—A new or improved process for treating metallic sulphurets, phosphurets, arseniurets, antimoniurets, and particularly sulphuretted ores of lead, antimony, copper, silver, and zinc.

Dated 1st February, 1859.

284. R. Needham, Dukinfield, Chester—An improved water-guage for steam boilers.

Dated 5th February, 1859.

336. T. R. Ayerst, Newenden, Kent—Imp. in breech-loading guns and other fire-arms. (A com.)

Dated 8th February, 1859.

353. W. Waller, Chesterfield, Derby—Imp. in agricultural or farm implements or apparatus. (Partly a com.)

Dated 9th February, 1859.

368. G. Bower, Saint Neot's, Huntingdonshire—Imp. in apparatus for the manufacture of illuminating gas.

Dated 10th February, 1859.

376. W. A. Covert, Long Island, New York—An improved self-acting railway switch. (A com.)

Dated 11th February, 1859.

386. H. Bruce, Kinleith Mill, Currie, Midlothian, N.B.—Imp. in apparatus for the manufacture of paper.

Dated 12th February, 1859.

396. C. R. Moate, 65, Old Broad-street—Imp. in the manufacture of nuts, screws, bolts, spikes, and other headed fastenings. (A com.)

Dated 15th February, 1859.

417. C. L. Roberts, Clerkenwell—The manufacture of an improved cigar.
419. F. Walters, Sheffield—The application of the waste heat from puddling furnaces.
421. J. Paterson, Wood-street—Imp. in brace buckles and loops, and in braces.
423. G. Bedson, Manchester—Imp. in joining wire for telegraphic and other purposes.

Dated 16th February, 1859.

424. J. F. Tourrier, 41, Manchester-street, Manchester-square—Preventing oscillation of the last carriage of a railway train, and giving rigidity and steadiness throughout the train.

425. M. Crawford, Liverpool—An improved anti-fouling metallic varnish, applicable to ships' bottoms and other similar purposes.
426. S. Bailey, Wednesbury, Staffordshire—Certain apparatus for preventing the skip in mine operations being pulled over the pulley on which the rope or chain works. to which such skip or cage may be attached, as well as preventing the skip or cage re-descending until put in motion for that purpose.
427. R. Cookson, Layton Hawes, near Blackpool, Lancashire, and C. W. Homer, Castle-hill, near Northwich, Chester—Imp. in machinery for making bricks, tiles, tubes, and other articles of plastic materials, and in the mode of jointing drain pipes.
428. C. E. Wright, Nottingham—Imp. in means or apparatus employed in the nursing or treatment of infants.
429. R. J. S. Pearce, Fleet-street—Imp. in weighing and dynamic machines.
430. P. M. P. Bourjeaurd, Davies-street, Middlesex—An improved apparatus for supporting the womb.
431. W. E. Newton, 66, Chancery-lane—An improved mowing machine or grass harvester. (A com.)
432. A. V. Newton, 66, Chancery-lane—An imp. in the construction of brushes. (A com.)
433. W. E. Newton, 66, Chancery-lane—Improved machinery for making bricks. (A com.)
434. W. H. Horstmann, New York—Telegraphic cables, and the mode of constructing the same and laying them down.
435. J. J. Russell, Wednesbury, Staffordshire—Imp. in machinery used for heating and welding the edges of the plates used in the manufacture of cylinders and other articles.
436. W. A. O'Doherty, 5, Eastcheap—An imp. in black lead pencils and pencil cases. (A com.)
437. J. Seguin, 4, Grande Rue de Gravelle à St. Maurice (Seine), France—Imp. relating to the employment of moving power arising from the tides and its application to manufacturing, agricultural, and other purposes.
439. J. Breeden, Birmingham—New or improved machinery for the manufacture of taps or stopcocks, and fittings for gas, steam, and water pipes.
440. J. Eason, Oxford-street—Imp. in apparatus applicable to tanning, dyeing, and obtaining extracts from vegetable, animal, and mineral substances.

Dated 17th February, 1859.

441. S. T. Cooper, Upper Clapton—Imp. in the use and application of artificial light.
443. Capt. H. Y. D. Scott, R.E., Brompton Barracks, Chatham—An imp. in the manufacture of cement.
444. B. Gaillard, Lamb's Conduit-street—An improved mode of obtaining printing plates from collodion pictures.
445. P. E. Fraissinet, Paris—A new or improved structure of iron, applicable for paving, flooring, bridges, gratings, girders, and other like purposes.
446. T. Cattell, 30, Euston-square—Imp. in treating and purifying gutta percha.
447. F. W. Emerson, New Charlton, Kent—Imp. in the treatment of certain ores of lead, and obtaining from them valuable primary and secondary products.
449. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for propelling and steering vessels and other floating craft. (A com.)

Dated 18th February, 1859.

450. J. J. Cole, 24, Essex street, Strand—Imp. in venetian and other suspended blinds, and in the method of hanging and working them.
451. C. Garton, Bristol—An improved method of treating cane sugar, in order to render it fitter to be employed in brewing, distilling, and wine and vinegar making.
452. H. Swaisland, 54, Great Sutton-street, Clerkenwell—Imp. in box sextants.
453. G. Wallis, Stretton, near Penkridge, Staffordshire—A new or improved method of engraving, applicable to the production of printing surfaces and the ornamentation of metallic and other surfaces.
454. G. Kammerer, Lombard-street—Improved gearing for gins or horse mills, applicable for grinding, winnowing, and other purposes requiring motive power. (A com.)
455. W. Clark, 53, Chancery-lane—Imp. in emptying cesspools, and in raising other fluid and semi-fluid matters. (A com.)
456. W. Clark, 53, Chancery-lane—Imp. in pressure gauges. (A com.)
457. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of textile fabrics, and in the machinery or apparatus employed therein. (A com.)

Dated 19th February, 1859.

458. P. A. J. Dujardin, Lille, France—Imp. in the printing apparatus of railway telegraphs.
459. A. R. Le Mire de Normandy, 67, Judd-street, Brunswick-square—Imp. in an apparatus for obtaining fresh water from salt water.
461. W. Clay, Liverpool—Imp. in the manufacture of deck and other beams, and of angular and other bars of various forms.
463. S. Wheatcroft, Brudenell-place, New North road—Imp. in the method of, and the means for, uniting lace to blond and other fabrics, and also in the apparatus used for manufacturing or converting the same into bonnet and cap fronts, rouches, and such like similar articles of millinery.
464. C. F. Vasserot, 45, Essex-street, Strand—An improved apparatus for manufacturing the strands of wire-ropes. (A com.)
465. C. F. Vasserot, 45, Essex-street, Strand—An improved carding machine. (A com.)
467. F. P. J. Van den Ouwelant, Paris—Imp. in apparatuses to be applied to fire places for obtaining a more complete combustion of the fuel employed therein.

Dated 21st February, 1859.

468. G. Paul, Glasgow—Imp. in spindles and flyers.
469. O. Blake, Blackwall—Improved machinery or apparatus used in the manufacture of glass.
470. G. McCulloch, Manchester—Imp. in machinery or apparatus for spinning doubling, and throwing silk, and doubling other fibrous materials.
471. T. Wilson, Birmingham—Imp. in the manufacture and construction of ordnance.
472. A. Belpaire, Brussels—Imp. in the reversing gear of locomotive and other steam engines.
473. G. Humphrey, Deptford, Kent—Imp. in meters for measuring fluids and gases.
475. R. Jobson, Wordsley, Staffordshire—Imp. in supplying water or other fluid to axletree boxes and other journal bearings to lubricate the same.
477. R. W. Johnson and W. Stableford, Oldbury, Worcestershire—Imp. in axle boxes.

Dated 22nd February, 1859.

479. T. Smith, Chatteris, Cambridgeshire—Floating wheels for driving machinery.
480. W. Soleman, 3, Bennett-street, Middlesex—Imp. in the construction of propellers.
481. J. Grimond, Manchester—Imp. in the treatment and preparation of jute and other fibrous materials, and in machinery or apparatus employed therein.
482. J. Curtis, Drury-lane—The manufacture of military sash net, and machinery to be employed therein.
484. J. Hine, Clerkenwell—An improved book slide.
485. E. Lund, Manchester—Certain imp. in the manufacture of fabrics or textures to be used in the construction of umbrellas and parasols.
486. R. A. Brooman, 166, Fleet-street—Method of fixing tannin upon textile fibres, and the employment thereof in dyeing black and dark colours. (A com.)
487. T. R. Harding, Leeds—Imp. in the manufacture of card surfaces to be used in preparing fibrous materials.

Dated 23rd February, 1859.

489. A. W. Smethurst, Chorley, Lancashire—Imp. in machinery for driving looms for weaving.
491. W. Ashton, Heaton Norris, Lancashire—Imp. in gas regulators.
493. U. Scott, Camden-town—Imp. in carriages and various parts of the same, which parts may be applied to vehicles of any description.
495. S. R. Samuels, Nottingham—Imp. in twist lace machines.
497. G. Turnbull, Calcutta—Imp. in the permanent way of railways.

INVENTION WITH COMPLETE SPECIFICATION FILED.

584. F. Brignoles, 3, Duke-street, Adelphi—The disinfection and rectification of alcohols, by the separation of the essential and other oils from the alcohol.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, March* 4, 1859.]

March 4th.

2006. W. H. Child.
2027. B. Hockin.
2031. A. Lamb and J. White.
2041. J. Rowley.
2059. W. Toshach.
2066. J. L. Hinks.
2077. J. Turner.
2401. G. M. Casentini and J. O. Barnard.
2804. J. V. Scarborough.
2984. H. C. Vion.
50. J. H. Johnson.

[*From Gazette, March* 8, 1859.]

March 8th.

1811. W. Smith.
2043. C. N. Kottula.
2044. J. Tatlow & H. Hodgkinson.
2056. F. A. E. G. de Massas.
2058. D. Cheetham.
2071. W. Thompson.
2113. H. Barrow.
2175. J. Morrison.
25. R. Tempest and J. Tomlinson.
75. F. Lehr.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March* 4, 1859.]

February 28th.

528. J. Reading.
534. F. Kaselowsky.

March 1st.

567. A. Newburger.

March 2nd.

543. J. E. Hodges.
545. J. E. Hodges.

[*From Gazette, March* 8, 1859.]

March 3rd.

549. T. Lambert.
631. C. Randolph and J. Elder.

March 4th.

570. J. Downie.
609. G. Rees.
761. J. McLean.

March 5th.

576. H. Cooke.
626. R. W. Winfield, J. Simms, and T. Lloyd.

PATENT ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

March 4th.

761. J. McLean.

Journal of the Society of Arts.

FRIDAY, MARCH 18, 1859.

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th of April next.

Persons intending to be Exhibitors should communicate with the Secretary of the Society of Arts as soon as possible, stating :—

1st. The Title of the Invention.

2nd. Whether the Article will be a Model, Drawing, or Specimen.

The Articles must be forwarded to the Society's house, carriage paid. The days fixed for receiving them are Thursday the 7th, Friday the 8th, and Saturday the 9th April. No articles will be received after the last of these days.

Articles which have been included in previous Exhibitions of the Society of Arts cannot be re-admitted.

Articles should be accompanied by a short but clear description of the Invention, with a wood block (when possible) for illustration, and a reference to any publication in which the Invention is described.

All Drawings exhibited must be framed.

No charge is made for space, and the admission to the Exhibition is free.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

EXAMINATION PRIZE FUND FOR 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
— Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
Rev. A. Wilson	2	2

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following gentlemen have been added to the Local Board for the Birmingham Institute:—

Mr. Arthur Ryland, Vice-President.
Mr. Robert Wright.

The following Local Board has been appointed since the last announcement :—

For Manchester.

Professor Bowman, Victoria-park, Rusholme, Manchester.
Professor Greenwood, Principal of Owen's College, Manchester.
Professor Hall, Independent College, Brook's Bar, Manchester.
Mr. Jas. Kayton, Embden-street, Greenheys, Manchester.
Mr. Jos. Manchester, Stretford, near Manchester.
Professor Newth, Independent College, Brook's Bar, Manchester.
Mr. A. Ransome, St. Peter's-square, Manchester.
Mr. R. Rumney, Ardwick, Manchester.
Dr. R. A. Smith, Grosvenor-square, Manchester.
Mr. E. Hutchins, Mechanics' Institution, Manchester, *Secretary.*

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

The following letter has also been issued to the Secretary of each Local Board :—

14th March, 1859.

Dear Sir,—I shall be obliged by your informing me, without delay, whether you have any Candidates desiring to be examined in Music, as, if so, I will furnish you with a copy of the form of test to be used at the Previous Examinations, as mentioned in Paragraph 74 of the Programme.

I am, dear sir, yours faithfully,
P. LE NEVE FOSTER, Secretary.

BOARD OF EXAMINERS.

At a meeting of the Board of Examiners held on Friday, the 11th inst., Mr. Charles Brooke, M.A., F.R.S., was elected Chairman for the present year.

ENGLISH ART IN FRANCE.

The following circular has been issued to artists by the President of the Royal Academy :—

Sir,—I beg to acquaint you that I have received communications, dated the 1st and 7th of this month, from H.E. "Le Ministre d'Etat et de la Maison de l'Empereur," confirming, by the following regulations, the liberal invitation before made known by M. Silvestre to the artists of this country :—

A special room will be reserved in the "Palais de l'Industrie" for the reception of about two hundred works by English artists.

The second condition proposes that works offered for the Paris Exhibition should be first examined by an English Jury. On this point I thought it necessary to submit to H.E. the French Minister that some difficulty and delay might ensue, and I ventured to suggest that a representative of the French Exhibition Jury should be either deputed to this country or appointed here by the French authorities to decide on the selection. But H.E., in reply, adheres so far to the original condition as to require that the Jury or the individual, appointed to select the works, should be English, and nominated by English authorities. I must therefore leave the solution of this difficulty to those artists who propose to exhibit.

Works admitted by the Jury will be consigned to Mr. Ernest Gambart*—Director of the Annual Exhibition of French Pictures in London—who will undertake their conveyance.

The "Directeur-Général des Musées Impériaux" will deliver to Mr. Ernest Gambart, or to his agent, receipts for such works on their arrival at the "Palais de l'Industrie."

All works must be deposited in the "Palais de l'Industrie" at the latest on the 10th of April next.

At the close of the Exhibition the works of the English artists will be returned to Mr. Ernest Gambart, who has undertaken to send them back to England.

Should the English exhibitors be disposed to sell their works, they can communicate their conditions to the "Directeur-Général des Musées Impériaux," either directly or through Mr. Ernest Gambart.

For the expenses attending the arrangement and conservation of the works during the Exhibition, the French Administration will be responsible. For the expenses of conveyance to and from Paris, the artist exhibitors will be responsible.

Should you require any further information on this subject generally, I have to request that you will communicate with Mr. Ernest Gambart.

I have the honour to be, Sir,
Your most obedient servant,
C. L. EASTLAKE.

7, Fitzroy-square, 8th March, 1859.

FIFTEENTH ORDINARY MEETING.

Wednesday, March 16, 1859.

The Fifteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 16th inst., Sir Richard Bethell, M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Begbie, Robert Spear
Clough, Arthur Hugh
Dod, Charles
Hetley, J. H.
Kerr, Peter

The following Institution has been taken into Union since the last announcement:—

Canterbury, Church of England Young Men's Literary Association.

The Paper read was—

ON TRADE MARKS.

By Professor Leone Levi, F.S.A., F.S.S., &c.

The lofty position gained by the British manufacturer in the markets of the world, is, indeed, one of considerable difficulty and delicacy. Exposed to open competition at home and abroad, it is not sufficient for him to have secured such a position by dint of industry and perseverance; he must maintain it by constant efforts towards absolute excellence. It is not enough that he has gained an enviable reputation; he must continue to deserve it. Let there be the smallest declension in the quality of the materials, or in the preparation of the article—let there be, in short, the least diminution of absolute merit—and the British manufacturer will cease to enjoy the supremacy which is now everywhere freely awarded to him. Time was when, with an almost exclusive monopoly of machinery, he stood alone, at least, as the possessor of useful and cheap materials. Now even this disparity between the high-priced foreign manufacture and the moderately-charged British goods is fast disappearing. Let the British manufacturer realise the altered condition in which he is placed, and provide for its exigencies.

Fortunately, however, the British manufacturers are well alive to such demands upon their skill and energies, and we see them everywhere striving to rival all competitors, and to maintain untarnished the reputation they have gained. Their aim is to produce an article which, for its price, may be unequalled and unexcelled in this or any country; and, whenever they stamp such articles with their names, cyphers, or labels, they enter into solemn guarantees that the goods so marked shall invariably be of the quality represented. Their endeavour is to establish such an intimate relationship between the mark and the manufacture, that, in whatever market such goods may be presented for sale, the same may be received with the most implicit faith and reliance. A mark on a manufacture, is, in fact, like the impress of the Sovereign on a coin—a sufficient evidence, universally accredited, that the coin is of a specific weight and fineness; and so, in the middle ages, the mark was not the simple signature of the merchant or manufacturer, but a certificate of guarantee, given by public authority, touching the quality of the produce, its origin, weight, &c. And the British manufacturers have succeeded in establishing such a reputation for their marks. The largest portion of articles of their manufacture is sold in foreign markets by such marks, and the prices vary according to the different marks or labels. The confidence is indeed unlimited. Not the slightest doubt is ever entertained but that the quality of the articles will at all times prove identically the same. In China, India, Spain, Italy, everywhere the same amount of confidence exists.

This is the fruit of a long continued adherence on the part of the manufacturer to maintain unaltered this correspondence between the quality and the mark, and to do aught to destroy such confidence would be for him a suicidal deed against his own reputation. But what he does not do for himself, others unfortunately do for him; and he is frustrated in all his endeavours by the ingenious deceptions practised upon his labels and marks, and even upon his own name. The ways in which such piracies are effected are often curious and bold. To give some palpable instances, here are two real cases brought before our courts. A Mr. Leathart, of the Burlington Arcade, invented a greasy composition for the hair, and styled it "The Medicated Mexican Balm," which was sold as Perry's Medicated Mexican Balm. No sooner was this known, than a Mr. Truefitt, a rival hairdresser and perfumer in the same place, made something similar, and called it Truefitt's Medicated Mexican Balm.

The other case is even more singular, of an individual taking undue advantage of his name being similar to that of a celebrated manufacturer. Every one is acquainted with the well-known advertisement:—

THE MIGHTY HEALER!
WORLD-KNOWN AND WORLD-TRIED,
HOLLOWAY'S OINTMENT.

I am not prepared to indorse the recommendations given by that band of individuals who have thereby been cured of their gout, rheumatism, and other diseases, having never, happily, had occasion to resort to such cures, but certain it is, that Holloway sells his pills at

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* 25, Berners-street, Oxford-street, W.

244, Strand, and that a constant flow of anxious customers daily resort to this British Æsculapius. What must have been his surprise upon finding one day another Holloway a few doors off setting up an opposition by the title

H. HOLLOWAY'S PILLS AND OINTMENT,

and giving pill-boxes and pots exactly similar in form to the labels and wrappers he had always used? I might multiply cases of this nature, in every trade and in every manufacture.

It may be well, however, to state distinctly what is the trade mark of which we speak, and in what manner it is commonly used. The mark may consist of the name of the manufacturer, or a seal, or a vignette, or any letter, in whatever manner placed, or a cypher, or a wrapper, coloured or not, or any other sign serving to distinguish the products of a manufacturer. It may be adhesive, or non-adhesive. It may be put inside the article or outside. It may be the emblem of anything, such as a cross, a bird, a quadruped, a castle, a star, a comet, a sun, &c. Nor is it necessary that this emblem be new; suffice that its application be new, that is to say, that it has not been employed as yet as a distinctive mark of similar products. The vignette employed as a mark may represent a public establishment, or a view of anything. The mark may be composed of initials combined together or separate; the letters may be in different forms, straight or inverted; in any manner, in fact, provided they constitute a mark differing from all other marks. Where the simple initials are used without any other distinction they cannot afford sufficient security, because there may be manufacturers bearing names with the same initials, who would have a right to use the same mark. Numberless examples might be given of such marks. For instance, Manchester cotton-yarn is generally sold in bundles covered by a ticket representing either a lion or any other object, in different colours. Shirtings and other goods have the names of the manufacturers printed in red or blue on the piece itself. Iron has marks impressed on the bars. Paper has a water mark. We hear of "Bass's Ale," of "Glenfield's Patent Starch," of "Taylor's Persian Thread," of "Nevill's Digestive Bread," and many other like articles. Moreover, we have the many patented articles with the names of the manufacturers attached. In fact, most articles of trade bear either one or other distinctive mark. In all such cases the exclusive possession of such marks, if favourably and extensively known, is itself a real source of wealth to the manufacturer, thus securing for himself and his successors, not only an honourable reputation, but a just reward of his efforts.

Now the counterfeiting of such marks supposes an imitation designedly calculated to prejudice the person who first used it. Therefore, to prove a counterfeit there must be three things, first, the imitation; second, the imitation with *the intent to defraud;* and third, an injury caused, or attempted. Where, for instance, the imitation is casual or involuntary, there would be no counterfeit. It is easy, however, to distinguish between a fraudulent and an innocent or involuntary imitation. The law in this country is clear on the subject. No man has a right to sell goods of his own manufacture upon a false and deceitful representation that they are of the manufacture of another. No man has a right to dress himself in colours, or adopt and bear symbols to which he has no peculiar or exclusive right, thereby to personate another person for the purpose of inducing the people to suppose either that he is that other person, or that he is connected with him, and selling the manufacture of such other person, while he is really selling his own. Whenever it is found that a fraudulent attempt is made to pirate another person's name or label, the Courts of Equity in this country grant a remedy, by an injunction, to restrain such party from using the name or label of another. It is not that an individual has a right to such name or mark. A man cannot acquire a property merely in a name or mark, but another person has no right to make use of that name or mark for the purposes of deception. In the words of the Lord Chancellor, in a recent case, this right cannot properly be described as a copyright; it is, in fact, a right which can be said to exist only by its violation; it is the right which any person designating his wares or commodities by a particular trade-mark has to prevent others from selling wares which are not his, marked with that trade mark in order to mislead the public, and so incidentally to injure the person who is the owner of the trade mark. A manufacturer has, therefore, a right of action against any one who affixes to his goods the mark he is accustomed to use upon his own, and sells them upon a representation that they are of the manufacture which such mark would denote them to be. Of course, in order to establish a right to damages, it would have to be proved that the defendant had adopted a mark so like the mark of the plaintiff as to be calculated to impose upon ordinary persons, and to induce them to believe that the goods were the plaintiff's goods, and also that the acts complained of were done with the intention to deceive. The plaintiff himself must be accustomed to use a certain mark to denote that the goods so marked were of his own manufacture. He must prove that such mark was well known and understood in the particular trade, and that the defendant had adopted the mark and sold the goods bearing it, and for the plaintiff's goods, with intent to deceive. A few cases will best illustrate the requisites for a successful prosecution against the piracy of trade marks. Mr. Crawshay, an extensive iron master, marks his iron by his name, W. Crawshay, or W. C., enclosed in a ring, and this mark is universally known.

In 1837, Mr. Crawshay found in Mr. Thompson's wharf some bars of iron bearing a mark which he at first supposed to be his own mark W.C. but which on closer inspection he found to be W.O. Mr. Crawshay ascertained, moreover, that this mark commonly passed in the Turkish market for his own mark. Although this mark was not exactly like Crawshay's, yet the "O" which was substituted for the "C" was, in conjunction with the "W" and the ⬭ so palpable an imitation of his mark, that it left no doubt as to the intent. A suit was thereupon instituted by Crawshay against Thompson. Mr. Thompson admitted that he often executed orders for the Turkish market with iron stamped W.^{o} and ^{o}W. The application was, however, dismissed, because there was no sufficient proof of any intention on his part to imitate the mark of Crawshay.

Another requisite, we have said, is, that the plaintiff must prove that he has suffered damage from the alleged piracy. A Mr. Lawson was the promoter of a bank, to be called "The Bank of London." He had incurred expenses in putting up the name on a brass plate, and in publishing prospectuses, but he was beaten in the race, and other parties established the bank by that very name. Mr. Lawson never carried on the business of banking—had not a single customer, and was therefore not in a position to be damnified. Under such circumstances no suit could be maintained. Such is the state of the law on the subject.

There are, indeed, some old laws on some special branches of trade respecting trade marks. Thus, by a statute of George II., persons affixing stamps to foreign linens, in imitation of the stamps affixed to those of Scotland and Ireland, forfeited £5 for each offence, and persons exposing for sale, or packing up any foreign linens as the manufactures of Great Britain and Ireland, forfeited the same, and £5 for each piece of linen so exposed for sale or packed up. So the legislature empowered the Goldsmiths' Company to call upon the manufacturers to bring all the articles they made to their Hall for the purpose of being assayed and stamped with their Hall mark; but various exemptions from Hall-marking were sanctioned by law. In the same manner the Cutlers' Company of Sheffield were empowered to grant marks to any persons carrying on any of the incorporated trades, with power of summary jurisdiction before two magistrates to enforce such regulations. Apart, however, from these special laws, the general remedy now afforded against the counterfeiting of trade marks is by suit in equity, and the Court has repeatedly declared that a man is not to sell his own goods under the pretence that they are the goods of another man. Yet something is wanting at Common Law. It is not enough to have power to restrain another person from committing an act fraudulent in itself because it proves injurious to another. More is wanted. If such acts are criminal and fraudulent in themselves, why should they not be punished as such? If a person puts a false mark or token on an article, and sells the article by means of that false token, that amounts to a cheat, cheats being defined to be all deceitful practices, defrauding or endeavouring to defraud another of his known right, by means of some artful devices, contrary to the plain rules of common honesty. I need not say that it ought to be the business of the law to impress a character of probity and morality in trade and manufacture, not only by prohibiting the use of such deceitful practices, but by punishing the perpetrators of them as ribald adventurers who seek to make capital of other people's means and abilities. Yet all attempts at bringing such cases before a criminal court have failed. For instance, an artist of some celebrity, Mr. John Linnell, painted a picture and put his name on it. Recently a picture professing to be Linnell's original picture, and having Linnell's name painted on it, was sold at the shop of a picture dealer, named Thomas Closs, for £130. This was a clear deception. The party was indicted for obtaining money upon false pretences, and for forgery. Upon the former he was acquitted; but he was convicted of forgery. When the case came before the superior court the judgment was quashed, and it was decided that there was no forgery, forgery consisting in the false and fraudulent making or uttering of a written instrument to the prejudice of another's right.

Another case occurred lately, of somewhat the same nature, and with like results. A George Borwick was in the habit of selling certain powders, some called Borwick's baking powder, and others Borwick's egg powder. These powders were sold in packets, and were wrapped up in printed paper, containing the name of George Borwick, but the packets were so wrapped that the name was not visible till the packets were opened. A certain John Smith endeavoured to sell baking powders, but had them returned to him because they were not Borwick's powder. Subsequently he went to a printer, and representing his name to be Borwick, desired him to print 10,000 labels as nearly as possibly like those used by Borwick, except that the name of Borwick was to be omitted in the baking powders. The labels were printed according to his order, and a considerable quantity of Smith's powder was sold as Borwick's powder. The label ran thus:—

PATRONIZED BY THE ADMIRALTY.

BORWICK'S
ORIGINAL
GERMAN BAKING POWDER
FOR MAKING
BREAD WITHOUT YEAST,
PUDDINGS WITHOUT EGGS.

Then followed the directions, professing to be approved by the Queen's private baker; and then a memorandum to this effect:—

The public are requested to see that each wrapper is signed George Borwick, *without which* none is genuine.

Smith was indicted for forgery, but it was not held to be so, as the fraud consisted not in getting the name printed, because, in that case, he would have been guilty of 10,000 forgeries as soon as he got these wrappers from the printer; but in putting inside the wrapper powder which was not genuine, and selling that for the genuine Borwick's powder. It is indeed difficult to conceive any difficulty in considering such acts as forgeries. What difference does it make, whether the imitation of the handwriting of an individual, or the unauthorised use of his name be by the hand or by the press,—in one copy or ten thousand? The criminal act is all the same. It is like issuing a cheque with a false signature, or the passing of a counterfeit coin from the counter. In France all such acts are held to be *délits* or misdemeanours, and as such they are punished with penalties and imprisonment. By the French law the pirating or counterfeiting any trade mark; the using of such counterfeited mark; the fraudulent application of a mark belonging to another; the selling, or attempting to sell, any manufacture with a counterfeited mark, are punishable with a penalty of from 50 to 3,000 francs, and imprisonment of from three months to three years. We shall now sum up the state of the law on trade marks in this country, and I will avail myself of the following propositions, embodied in a recent article on the subject in a legal periodical:

1. That the first producer or vendor of any article gains no right of property in that article, so as to prevent others from manufacturing, producing, or vending it.

2. That although any other person may manufacture, produce, and sell any such article, yet he must not in any manner, either by using the name or similar marks, wrappers, labels, or devices, or colourable imitations thereof, or otherwise hold out to the public that he is manufacturing, producing, or selling the identical article prepared, manufactured, produced, or sold by the other, that is to say, he may not make use of the name or reputation of the other in order to sell his own preparation.

3. The right to use or restrain others from using any mark or name of a firm is in the nature of a good-will, and therefore going to the surviving or continuing partner in such firm, and the personal representatives of a deceased partner have an interest in it.

4. That Courts of Equity in these cases only act as auxiliary to the legal rights, and to prevent injury, and give relief by account where damages at law would be inadequate to the injury received; and they will not interfere by injunction in the first instance unless a good legal title is shown, and even then they never preclude the parties from trying the right at law if desired.

5. If the legal title be so doubtful as not to induce the court to grant the injunction, yet it will put the parties in a position to try the legal right at law notwithstanding the suit.

6. That before the party is entitled to relief in equity, he must truly represent his title, and the mode in which he became possessed of the article for the vending of which he claims protection, it being a clear rule of the Courts of Equity not to extend their protection to persons whose case is not founded on truth.

It makes no difference here whether the plaintiff is an alien friend or a native subject. An alien is not now regarded as the outside barbarian he was till lately considered in China, and the struggle in all commercial countries for some centuries has been to enlarge his privileges and power as to all matters of property and trade. By Magna Charta it was provided that aliens might be allowed to go and come, and buy and sell, without any evil tolls. The law of England, said Mr. Justice Hale, rather contracts than extends the disability of aliens, because the shutting out of aliens tends to the loss of people, who when laboriously employed, are the true riches of any country. An alien, even while residing abroad, might bring a suit in this country. In one case a M. Pisani, the chief of the Dragomans, attached to the British Embassy at the Ottoman Porte, was allowed to bring in a suit against the editor of the *Times* for libel. And so an alien friend using a mark, known and established as the mark of a special manufacture, could, in our Courts, obtain the same rights as a British subject against misusing and counterfeiting such mark. Thus, recently, the famous Jean Maria Farina, a Prussian subject, sued a certain Silverlock for having printed labels with the signature, "Jean Maria Farina gegenüber dem Julich Platz," with a particular flourish, and also a seal and stamp, which were attached to bottles of spurious Eau de Cologne. No question was made that Jean Maria Farina was a Prussian subject, out of the jurisdiction of her Majesty.

Of the same nature was the recent case of Collins and Co. This Company are manufacturers of edge tools in the United States of America, possessing great reputation in various parts of the world. They stamp on their manufactures the words, "Collins and Co., Hartford, cast steel, warranted," and also affix printed labels, with "Look for the stamp Hartford, if you want the genuine Collins and Co. Sam. W. Collins." A Birmingham merchant imitated the trade mark and labels of the company, and was in the habit of selling and exporting tools so stamped as being the tools of the company. The company, residing in America, sought to restrain the defendants in England from the use of the trade mark, and the injunction was granted. In the judgment, Vice-Chancellor Wood laid down the broad principle—"Every subject in every country, not being an alien enemy, is entitled to have a fraudulent injury to his property arrested at the fountain head, a right which is recognised in every civilised community." Something was indeed brought out in that trial which appeared extremely discreditable to both American and English manufacturers; a state of commercial morals which does discredit to all parties concerned, and it may be trusted that they are but few.

There we find the defendant admitting the use of the trade mark and labels of the Company, but stating that it was the custom at Birmingham for the manufacturers of goods to receive orders from merchants to affix thereupon particular trade marks, which is done accordingly as a matter of course, the manufacturers relying on the respectability of the merchant giving the order for his having authority to act as the agent of, or for his holding a proper licence from, the persons whose trade marks were so used. The same defendant, the Birmingham manufacturer, in his answer, further stated that he had been informed and believed that the Company had employed persons in England to manufacture goods in this country, and to attach to such goods the trade mark and labels of the Company, with a view to induce the public to believe that the goods so made by deputy, were in reality the genuine productions of "The Collins Company." Some disclaimer to such assertions has, it is true, appeared in the *Times*, but, if I am not misinformed, the practice of causing foreign manufacturers to execute orders for British goods, the same to be marked with British marks, is not uncommon with our manufacturers. Should this be true, we might say, ere we go to foreign courts and ask them to give redress for our grievances, let us purify our dealings—let us be perfectly clear of all such imputations.

The law of the United States of America is the same as that of England as respects the right of aliens. By a statute of New York, of 1850, forgery of trade marks, with intent to deceive or defraud the purchaser or manufacturer, is made a misdemeanour, and the selling of goods with forged stamps *scienter*, without disclosing the fact to the purchaser, is likewise made penal. Aliens may assert this right in the courts equally with citizens. A manufacturer of sewing-thread, carrying on business both in America and England, sued another American manufacturer for having sold the thread with his mark. A defence was set up that the plaintiff was an alien, and that therefore he was not entitled to protection, but Mr. Justice Story said, "In the courts of the United States, under the constitution and laws, aliens are entitled to the same protection of their rights as citizens. There is no difference between the case of a citizen and that of an alien friend, when his rights are openly violated." Another American judge said, "Amity and courtesy are due to all friendly strangers, rather than imposition or pillage. Taking their marks and using them, as and for them, and for their damage, is like preying on a visitor, or inhospitably plundering a wreck on shore. To elevate our own character as a nation, and the purity of our judicial tribunals, it seems to me we ought to go as far in the redress and punishment of these deceptions as can be vindicated on any sound principle."

The state of the law in France is not so satisfactory. The French courts have declared that the laws which protect trade marks concern the natives only; but provision is made by the law of 1857, whereby foreign subjects may, by special treaties, be placed on the same footing as French subjects as regards trade marks. The law in question is as follows:—

"Art. 5. Les étrangers qui possèdent en France des établissements d'industrie ou du commerce, jouissent, pour les produits de leurs établissements, du bénéfice de la présente loi, en remplissant les formalités qu'elle préscrit."

"Art. 6. Les étrangers et les Français dont les établissements sont situés hors de la France, jouissent également du bénéfice de la présente loi pour les produits de ces établissements, si, dans les pays où ils sont situés, des conventions diplomatiques ont établi la réciprocité pour les marques Françaises. Dans ce cas, le dépôt des marques étrangères a lieu au greffe du Tribunal de Commerce du département de la Seine."

The French law gives, therefore, no protection to British trade marks, until a treaty of reciprocity is made on the subject with France. The right granted to French subjects to sue in our courts in parallel cases is not sufficient. In consequence of this law, treaties have been already formed between France and other countries for the reciprocal protection of trade marks, viz., with Portugal on the 12th August, 1853; with Saxony on the 19th May, 1856; with Russia on the 14th June, 1857; with Baden on the 2nd July, 1857, and with Switzerland in October, 1858. These treaties provide "that any reproduction in one country of the trade marks used in the other shall be severely prohibited, and give right to actions for damages on the part of the party injured before the tribunals of the country where such piracy has been made. Where the subject of any of the two states wishes to secure his property in trade marks, he must deposit such marks in the places appointed by the two countries for the purpose." Such is the protection wanted by the British manufacturers in France and elsewhere. All that is required to be done is the formation of treaties on the subject, in order that we may obtain the same privileges as other powers have obtained under their special treaties.

In Prussia the law is sufficiently explicit as to the prohibition of using the name and mark of another, or putting in circulation such marks, with intent to deceive, but the courts are not ready to grant the same protection to foreign subjects, and whilst we allow a Prussian subject to sue in the British courts for an invasion of his right, the British subject would not be heard in theirs against the invasion of his right. It is a common practice with the German manufacturers to produce a low-priced and inferior article, wretchedly bad, upon which they unscrupulously impress the trade marks of the most celebrated Sheffield and other English makers. The same German warehouse will sell files marked Spear and Jackson, Marsh Brothers, &c., &c., and such counterfeited articles are sent from Germany to other countries under the colour of British goods, at very low prices. Thus the fishhook knife, the property of Bateman, which sells at 3s. 6d. per dozen net, is met by a spurious article sent out from Prussia at 1s. 5d. per dozen. Needles are sent from Germany at 10d. per thousand, imitating English articles varying in price from 3s. to 6s. These are some specimens of British marks printed in Germany and placed over German goods.

WARRANTED BEST STEEL
MARKED IK KENYON
Manufactured by John Kenyon & Co.
SHEFFIELD

Sometimes they make trifling mistakes in printing English names or words, but this seldom happens, and the mistakes are never sufficiently conspicuous to defeat their object of deception.

GENUINE IMPROVED SPRING STEEL,
FROM THE MANUFACTORY OF
WILLIAM GRAFES AND SONNS,
ZAWD WORKS, SHEFFIELD.

In addition to the marks stamped upon the goods themselves, it has been the custom of the English manufacturers to attach labels upon the separate parcels, indicating the name and address of the maker. These also have been copied exactly, and attached in the same way to their parcels by the German manufacturers, so that no difference is perceptible in the appearance of the parcels made up by the English, and those of their disreputable and fraudulent imitators. And as if to fill up the sum of their imposture, the Sheffield manufacturer having enclosed in such parcel of goods a printed notice of the deception thus practised upon the public, the Germans immediately had the effrontery to copy this also. Witness the following notice:—

GATE near SHEFFIELD

JOHN REDFERN'S
Superior Files
WARRANTED

JOHN REDFERN begs leave to state that frequent and various attempts have been made to imitate his Files with *spurious Articles;* and to prevent such Imposition in future please to *OBSERVE-none are of his manufacture but those stamped* S^{6}. Q and labelled on the outside wrapper with the same Mark and his Name JOHN REDFERN he being the ouly person authorised to use the said Mark.

Or this other:—

JOHN BEDFORD, SHEFFIELD.
The enclosed are warranted of
FIRST-RATE QUALITY.

Corporate Mark.	J	B	To imitate which is felony.
	O	S	

The result of these wholesale deceptions may well be imagined. They produce loss of reputation and loss of trade to the British manufacturer. The German houses profit by their indemnity to the utmost extent. Whilst they stamp all their inferior goods with the most celebrated English names and trade marks, they take care to put their own names upon any manufacture having the slightest pretensions to excellence; and thus they contrast the latter with the former, to the obvious injury of the English manufacturer. I am sure practices of this nature require only to be made known to secure a frank disavowal on the part of every honest manufacturer in Germany. The Prussian Government will surely not hesitate one moment in giving the most ample guarantees against the continuance of such dealings, and in return for the protection so generously granted in the British Courts to the plaints of any Prussian manufacturer, they will open their courts to the complaint of the injured British manufacturer.

That something is wanted in the Prussian law is quite evident from the following fact:—By the Criminal Code of Saxony, of 1838, it is provided that those who counterfeit the stamps, or particular marks, such as are usually attached to the produce and manufacture of mercantile houses, and use such marks or labels in trade, incur a penalty not exceeding two months' imprisonment, or a pecuniary fine. But, though the Prussian and Saxon laws respectively afford protection to their native traders, it was not clear that the same protection would be extended to the subjects of each others country. Frequent disputes arose as cases of piracy constantly occurred, and it became necessary for the two governments to come to a better understanding on the subject; hence the following declaration issued by the Saxon Government, in July, 1840:—

"Le Gouvernement Royal de Saxe et le Gouvernement Royal de Prusse étant convenus d'assimiler réciproquement les uns aux autres, et de traiter de la même manière leurs sujets respectifs quant à la protection légale de marques des marchandises, et en conséquence, le Gouvernement Royal de Prusse ayant déclaré que les dispositions de la loi royale de Prusse de Juillet, 1840, rélative à la protection des marques de marchandises, paragraphs 1 et 2, dévaient aussi rencontrer leur application en faveur des sujets du Roi de Saxe dans toute l' étendue de la monarchie Prussienne, les Ministres Royaux de Saxe soussignés, bien que la législation du Royaume de Saxe sur ce rapport ne fasse déjà elle-même aucune éspèce de difference entre les indigènes et les étrangers, déclarent néanmoins d'une manière particulière et expresse, que la défence avec l' indication de pénalité contenue dans l' article 252 du Code Criminal du 30 Mars, 1838, doit aussi être appliquée à la contrefaçon des timbres, marques particulières, ou étiquettes de négotians ou fabricans des états du Roi de Prusse."

The following is an extract from a proposed new commercial code for the whole of Germany, at present under the consideration of the Law Conference at Nürnberg:—

"Whosoever fraudulently marks goods, their wrappers, or packages, with the names or trade marks of a manufacturer, producer, or merchant, or with his knowledge or connivance, allows such goods fraudulently marked to be sold, is liable to a fine of 180 dollars for each offence. The same penalty is incurred if the goods, their wrappers, or packages are fraudulently marked with the names or trade marks, and place of residence, or place of manufacture of a manufacturer, producer, or merchant resident in a foreign country, provided that in the state to which the foreigner belongs reciprocity in duly guaranteed by treaty."

The above penalty is also incurred if the trade marks, &c., and places of residence are so imitated as to deceive the public in purchasing the goods.

In Belgium, trade marks are protected by the courts, though there does not appear to be any positive law on the subject. The same may be said as to the state of the law in other countries. The difficulty connected with the subject arises from the fact that trade marks cannot be considered as coming under the idea of property entitled, as such, to the protection of the law; and that wherever such right is granted, as in the case of copyright, it is confined to native subjects, and is not extended in favour of subjects of foreign countries. Yet, as literary and artistic property have been protected by treaties, securing an international copyright and an international patent right, so we should endeavour to protect industrial property by securing an international right to trade marks; and to that effect we should enter into treaties with foreign powers in the same manner as France has already done. Doubtless we have nothing to offer in exchange for the protection demanded, inasmuch as we do already afford such protection to all foreign subjects; and we could in no case entertain the question of shutting our courts to the subjects of such countries as will unjustly refuse to satisfy the demands of our manufacturers against the most barefaced piracies. We should never commit a moral wrong because a right is refused to us. In the event of such treaties being entered into, a place of registration of such trade marks would have to be provided in the same manner as in the case of patents and copyrights of designs. In France the registration is valid for fifteen years, after which it must be renewed.

I have thus brought before the society the state of the law on trade marks in this and other countries. The subject is an important one for our manufacturers, and any defect in the law should be carefully considered and provided for. It is essential to remove any difficulty that may exist in our criminal law, for the purpose of visiting with high penalties those who counterfeit, pirate, abuse, and forge the names, cyphers, and trade marks of others, thereby defrauding the injured parties, obtaining money under false pretences, and otherwise perpetrating an open public deception and fraud. And it is also necessary to obtain similar guarantees from foreign powers, so that the courts of all civilised nations shall be opened for the suppression of such practices by whomsoever, and against whomsoever, committed.

Mutual confidence is the bond which supremely binds together all the merchants of the earth, and whatever tends to destroy it saps the very foundation of national wealth. The Eastern nations are instinctively confiding, trusting, believing. They have faith in the word of a merchant, in his acts, in his promises. Other nations are more disposed to cavil and to scepticism; but however varied these natural dispositions, they find no corresponding outlet in commerce. There, no other principle is allowed to rule but one of mutual trust. Interest demands it; experience sanctions it; and how stinted, how unsatisfactory, and how insecure would commerce be without it. Every act of trade, by which operations of an unlimited amount are daily transacted, is essentially founded on confidence. Millions are hourly transferred from hand to hand by the simple delivery of pieces of paper, such as a bill of exchange, a bill of lading, or a policy of insurance, and contracts of immense quantities of produce and merchandise are made by the simple description of a mark or a manufacturer's name. Let confidence in such instruments or in such descriptions be once abandoned, and commerce will no longer be the swift revolutioniser of nations—the civiliser of mankind.

DISCUSSION.

The Secretary read the following letter from Mr. William Stones, who says:—

Frauds against English trade marks may be divided into three classes.

1. Cases in which one English manufacturer forges the marks of another manufacturer, the goods being intended for sale either in the home-market or abroad.

2. Cases in which foreign manfuacturers imitate English marks, for sale in their own countries.

3. Cases in which foreign manufacturers simulate English marks, the goods being intended for exportation to other countries, or the English colonies and possessions.

Now, I apprehend that there would not be so much difficulty found in framing laws to meet these cases, as would be experienced in carrying them out when made, and the detection of the frauds themselves presents a still greater difficulty.

Two or thre of the grossest frauds of trade marks which ever came under my notice were discovered accidentally, I may say.

Some years ago, just at the close of business hours, a parcel of paper was tendered for delivery by a railway company. As we had no advices nor even had a correspondent at the place whence they were forwarded, they were declined. The nonplussed carman solicited advice in his difficulty, and produced a bundle of the paper, with a view to obtain some hints as to the proper destination.

A little amusement and astonishment were caused by the discovery that the paper professed to be made by a manufacturer who, it was quite certain, knew nothing whatever of the place or transaction, had never sanctioned the use of his name, and, so far from benefiting, suffered serious damage in reputation, the article being intrinsically less than half the value of the same description of paper made by the genuine manufacturer.

On another occasion the customs authorities met with a curious kind of fraud, coming under my third class; and from all I can learn, this is the form attended with most injury to English manufacturers, and why I suggest the point of difficulty of carrying out any laws which might be agreed upon.

Many goods go direct from foreign ports, as Antwerp, Hamburg, Havre, or other foreign ports, and to our colonies, and the articles exported never come under any official inspection; it is only when they arrive at a home port for transhipment that, by chance, frauds are sometimes detected; of such is the one I refer to.

On a sheet of paper which I send, you will perceive the name of the manufacturer at full length on one side, and under the general trade size mark, common to all the trade, the initials of the individual manufacturer in a sort of monogram.

This is the usual form.

It so happened, however, in the case I speak of, that the name of this particular manufacturer was not the one required to be imitated, and therefore the one popular in the market to which these goods were going to be shipped was inserted on its proper side, at full length, except that the mould or frame maker, in his endeavour so to slightly alter the name that it should pass muster, turned it into a remarkable compound, such, for instance, as if, instead of C. Dickens, one should put a Q instead of the letter D.

Nor was this the only mistake; the workman had evidently copied the markings from a sheet like the enclosed, but mistook the monogram for a part of the general size-mark; the whole resulted in the paper having a mis-spelt English name in full on one side of the sheet, and the initials of a totally different firm on the other.

I need scarcely say, that the false was vastly different in quality from the *bona fide*.

These instances may suffice as illustrations of the 1st and 3rd classes of frauds.

Of the second, I believe, many instances could without difficulty be named, and some of these may be considered perhaps evasions rather than frauds, "fibs" of a neutral tint.

There are so many Londons, Kents, &c., in the United States, that it is not strictly untrue to say that many American-made articles are London-made Kent-made, the buyer at first happily dreaming that they are the produce of the old country; and, taught by his experience, particularly if he happens on some other occasion to have purchased some good article stamped with the name of an American firm (although actually made in England), he comes to the pleasing conclusion that in manufactures as in all things, our cousins can "lick the Britishers somewhat considerably."

The CHAIRMAN said—We have heard from Professor Leone Levi a very able and most instructive paper. There are several points in it to which, with the permission of the meeting, I will beg leave to direct your attention. As I collected from Mr. Leone Levi's statement, one very important topic is, the question whether frauds of this description ought to be made the subject of criminal enactment. Now, a fraud of this kind is in reality the theft of a man's reputation. The thief obtains at once the fruits, probably, of a life of labour, invention, and industry; and one particular reason why I think it should be made the subject of criminal enactment is this—that it is utterly impossible, in by far the greater number of cases, to obtain anything like an effectual remedy by civil proceeding, whether that proceeding be of a preventive character, in the shape of an injunction to restrain the injury, or whether in the shape of an ordinary action at law to obtain damages for the injuries committed. I say effectual, because it constantly happens that a particular market is forestalled by the thief, who floods the market with a great quantity of these pirated articles, which are received and taken into stock by the traders in distant countries, and the consequence is the real owner of the article so pirated has no opportunity, at all events for that season, of obtaining a reception of his own goods into the market. The evil is effected by persons who are out of the reach of the law at the particular time when the mischief is committed, and who escape the consequences, therefore, of any civil proceedings, sometimes because they are scarcely worth the expense of such proceedings. But those individuals would be much deterred if the act were made the subject of criminal law; and not only is the reason I have mentioned a valid one, as I submit, for such a change, but there is another circumstance which renders thefts of this description more particularly deserving of being brought under criminal enactment, that is, that the act done not only perpetrates a felony with a fraudulent intention upon the property of another, but is accompanied with fraud and imposition upon the public at large. Each man who buys is defrauded. It is not merely that my property is invaded, but the whole public are injured by the imposition. I cannot, therefore, but think that the suggestion made is worthy of your consideration, and one great advantage of a meeting of this kind is, that when a public want or a public injury has been represented to a body of gentlemen like this, the merits and propriety of meeting that want are discussed; public opinion is thus ascertained, and no law can be really effectual and useful unless one in the requisition for which and in the execution of which public opinion goes along with the enactment. There is another subject, however, which is certainly much more important, and this has been introduced in an admirable manner by the Professor. It is one which I am sure we should all desire particularly to follow out, and even, although we may not live to see the result future generations may hope to obtain it. Efforts ought therefore, I think, to be made in that direction, for it would be a great boon if the nations of Europe, who have already agreed together upon some maxims and general rules of morality and of public conduct, which are commonly called international laws, could by one common meeting together, by sending delegates from every country, agree upon a code of commercial law that should be universal throughout Europe, and the principle and the morality of which, being well founded, should be recognised and adopted by similarity of enactment in every country. The Professor rightly says we open our courts to foreigners in this particular description of injury, and we have done so much to our credit. The reason we have done so, however, is at once obvious. If a pirated article is brought into this country and sold here, which is the occasion of an application to the tribunals, the tribunals entertain the application because it is a wrong done to the British public; and that has been generally recognised by our courts. I have myself obtained injunctions of a similar kind. I may mention two of them, both of which were of particular interest. There is a champagne of very exquisite flavour when genuine, called the Duc de Montebello's Champagne. It was introduced into this country in bottles of a peculiar make, and with distinguishing labels, but these had been fraudulently imitated to assist the introduction of some bad gooseberry wine. An injunction was applied for to restrain that fraud; the private property of the Duke was protected, and at the same time the English public were saved from the imposition. Another article of a similar kind also came within my own practice—the liqueur Maraschino, produced, when pure, upon the estates of a Hungarian nobleman, the Count de Zara. He applied for a similar injunction, and it was granted without difficulty. It is true that in this respect we are entitled to some credit; but another part of our law which is, on the other hand, somewhat exclusive, should also be considered, because, you are aware, our patent law gives a privilege, not merely to the English inventor but also to the person who brings into this country a foreign invention. Therefore we must not be quite so ready to criticise the conduct of foreign nations without at the same time observing that that part of our own policy may be so represented as to be at variance with the principles of public morality; for that patent law has really permitted an Englishman who goes abroad and gets hold of the invention of some foreigner, to come to this country and secure to himself, on the ground of its being the first introduction, the exclusive right to vend, and profit by, that invention in these realms. That right was established by an act of the reign of King James I., and at those times, when there was but little communication between the different states of Europe—more particularly between this island and the continent—it might have been useful to hold out inducements to bring to this country foreign inventions. But if we require universal reciprocity, that part of our law must be repealed. If we ever agree upon a universal principle of commercial law, it must be framed in accordance with the general dictates of morality, and the courts of every country should be opened to the complaints of individuals wherever they prove that a breach of faith in this respect is committed within the jurisdiction of the courts appealed to. The advantage to Europe—the advantage to every country, not only commercially but morally, in drawing the nations of Europe into closer contact with each other, putting an end to individuality of interests and creating a community of interest and thought upon this subject, is an advantage the effect of which can hardly be estimated. Apologising for having thus occupied your attention, I shall now be happy to hear the remarks of gentlemen present upon this subject.

MR. HENRY VALLANCE (of Essex-street) considered that any legislative enactment upon this subject ought rather to be directed against the fraudulent manufacturer of spurious articles than against the vendor. Many cases of injunction had occurred against vendors of articles who were quite unaware that they were selling a fraudulent manufacture, and who could not claim protection, though they had purchased them under the impression that they were genuine. In any future remedy to be provided, he suggested that protection should be given to innocent vendors of fraudulent manufactures, and that the remedy should be taken against the manufacturers, who were the really guilty parties. The case mentioned of Jean Maria Farina was a striking illustration of this. His labels being imitated with great correctness, vendors of Eau de Cologne had purchased it, believing the goods they sold to be genuine. There was one curious fact in connection with this subject. The printers of manufacturers' labels were not held responsible for imitating the labels of others unless it could be shown that they had done so with a fraudulent intent; and it had been shown that label printers would supply any quantity of labels of any particular kind to anyone who asked for them. Upon this subject the late Lord Chancellor Cranworth laid down a principle which created considerable astonishment amongst the manufacturers as well as the legal profession. His lordship held that any person in England might imitate the signature and label of a manufacturer, provided he applied it to the actual productions of that manufacturer. It was contended, on the other hand, that every manufacturer had a right to control the application of his own distinctive trade mark; but Lord Cranworth had distinctly held the contrary. With regard to the French law upon this subject, from which Professor Leone Levi had read an extract, it appeared that foreigners were only protected in France in their manufactures, provided a diplomatic treaty of reciprocity existed between their country and France. In the cases that had been brought forward as regards France, it had always been objected that we had no statute or code which gave foreigners in terms the right to protect their manufactures in this country. Such right was only to be found in the decisions of the courts of law, and there was no distinct Act of Parliament under which that right could be claimed. We had never succeeded in satisfying the authorities in France that we had a law equivalent to their own code in this respect. Foreigners had asked to be shown the statute which gave them the right to protect their manufactures, but up to the present time it had been impossible to satisfy them on this point. He would venture to make two suggestions with regard to the protection of manufacturers in England; first, that there should be a proper register of trade marks, as was proposed some years ago, in which the trade mark should be registered in the name of the owner; secondly, that there should be some means of protection to manufacturers by their being allowed to subscribe to a general fund for their mutual protection against fraud as a body. At the present time such a combination by the subscription of funds for mutual protection was held to be illegal. He believed if such a modification of the law of maintenance, as it was called, could be obtained by act of Parliament, manufacturers would only be too glad to avail themselves of it, and would gladly contribute to such a fund.

Mr. **Winkworth** said that the subject opened up by Professor Levi with so much talent, and enforced by so much legal acumen and illustration by the high authority and experience of the chairman, as well as by Mr. Vallance, was rather a professional one than otherwise. Fraudulent imitations of marks stood in the same category as many other frauds, by which skill and reputation were deprived of their legitimate reward, and it appeared to him that one reason why that and similar injuries were perpetrated with comparative impunity, was that by attempting precise definitions, the law afforded too many avenues of escape, of which legal subtlety was not slow to avail itself. He thought that if the Law Amendment Society, of which the chairman was so distinguished and useful a member, would take up this question from his (Mr. Winkworth's) point of view, they might accomplish a most beneficial change. He would suggest that the remedy should in all cases, lie in civil proceedings, by which a pecuniary recompense in damages might be obtained by the injured party, rather than in forcing him to have recourse to a criminal court, where his loss might perhaps only be aggravated by a process of doubtful result, but of certain expense. He hesitated to propound this view, as he found himself opposed to an authority so deserving of respect as that of the Chairman. Mr. Winkworth then mentioned some peculiar frauds which had occurred in his experience, for which, as the law now stood, there was no remedy, and concluded by expressing the hope that this dark page of human weakness would ultimately be blotted out rather by the prevalence of moral suasion and strict principle than penal prosecution.

Mr. **Eddison** differed from Mr. Winkworth in the opinion that the Law Amendment Society was the more competent body to discuss a question of this practical character. It appeared to him of very great importance that, in any fresh legislation upon this subject, they should carry with them the opinions of those who might benefit or suffer by such a law. He fully agreed with the learned chairman that an expression of opinion from this Society would have its weight in the proper quarter. When they reflected upon what had been done by this Society in other matters, they must feel that it was better that the suggestions should come from lay-men rather than from law-men. After paying a high compliment to the chairman for the part he had taken in the passing of the act which made the misappropriation of trust money amenable to the criminal law, Mr. Eddison proceeded to argue the question of frauds in trade in a moral point of view, and contended that it was not sufficient that parties so offending should be dealt with by civil process, but that wherever fraud existed and was practised to the injury of others, it should be punished in the manner it deserved. If this question was taken up, he trusted it would be in the same way as had been done in the case of fraudulent trustees, putting aside all subtle distinctions, and coming at once to the point. When we became honest in our trading at home, then would be the time to talk of high moral principle, but so long as fraud in trade was practised to the extent it was still in this country, it was idle to look for reciprocity of dealing in other nations.

Mr. **Jones** said at the present day the English Hall mark upon gold watch cases was pirated to a very great extent in America upon gold below the English standard. Watches were sent from this country without the cases, and gold cases were manufactured in America, and the figures "18" were stamped upon them, as indicating 18 carat gold, whereas they seldom realised more than 14 or 15 carats. He had found that in India his own name had been extensively pirated upon watches. The injury thus done to the English manufacturer was not the whole of the case. It was a fraud upon the English workman, because it disgraced the quality of his work, thereby lowering our national reputation in particular classes of manufacture; and when the name of a celebrated manufacturer was put upon a spurious article, he lost his trade, as far as that article was concerned, when it was not discovered to be a fraud; his custom fell off, and the workman was thrown out of employment.

Mr. **Hobbs** did not know whether he rightly understood the object of this paper. One object, however, manifestly was to convince the meeting that there were a great many rogues in the world. With that they must all agree; but he thought another object was to prove that almost all the rogues were foreigners, and that there were very few rogues in England. If that was the object, he was not so satisfied on that point, for he believed there were as many dishonest traders in England as in any other part of the world. Dishonesty was not confined to trade marks alone; he thought the putting forth articles with a deceptive exterior, even without a false trade mark, was just as bad; and making people believe an article was good where it was not so was equally bad. With regard to the law upon the matter, he knew very little about that; but he thought it was a subject to be taken up by the moral reformers rather than by the Law Society; for if they could bring men to be honest in every particular they would accomplish a very great point. He did not quite understand the point upon which the trial of the Collins Company turned. He gathered from the reading of the paper that the Collins Company had authorised manufacturers in this country to make goods and put their stamp upon them, and he could not see any harm in that. If a manufacturer in America employed a manufacturer here to make goods, and put his stamp upon them, he did not see anything wrong in it, because he accepted the goods as his own, and took the responsibility of them. He believed he had a perfect right to give an order to another manufacturer to make goods in his name, so long as he was responsible for the quality of the goods. With regard to shutting out foreigners, China was mentioned. There was, in his opinion, a China nearer home; for, he believed, there was a law in existence precluding foreigners from opening shops. He had been told that he had no right to do so, unless he took up the freedom of the City. He came to this country under the idea that it was a free country, but it did not altogether appear to be so, although the law to which he alluded had become so unpopular that it was never put in force. In a subject of this kind he thought the appeal should be rather to men's consciences than to the aid of the law.

The Chairman said he thought the meeting generally would be hardly inclined to agree with the observations as to the Collins Company, which had been put forward by the last speaker. Let them suppose, for example, that he (Mr. Hobbs) had given an order to a manufacturer in Belgium to make locks, and put his name upon them, which, being a name of very deserved reputation, was accepted by the world as a proof that the locks were made in England, with the benefit of English skill and superior workmanship; in such a case the world would be beguiled into accepting an inferior article, the produce of the labour of unskilled artizans, in the expectation that they had an article of English material and English workmanship.

Mr. Hobbs, with all due respect to the Chairman's authority, thought that was begging the question. He could not admit that the English workmen were the best in the world, which fact was proved by the very case mentioned. Collins' edged tools and axes were the best in the world, and it was because English manufacturers could not make them so good that they copied the Collins mark.

Mr. May agreed with the learned Chairman that great good would result from the ventilation of this subject, in which manufacturers of all kinds were so much interested. He did not think they were called upon to discuss the question whether England was free from dishonest traders, or whether all the dishonest men were foreigners. Their own practical experience gave a sufficient answer upon that point; but that there was a great amount of unscrupulousness amongst foreigners in the branch of manufacture with which he was connected (watch-making), he could personally vouch for. Mr. May proceeded to instance cases in which the names of English manufacturers had been stamped upon watches entirely manufactured in Switzerland, which were exported and sold as of English make, together with other instances of a like fraudulent character, particularly in India. He considered that those who were more practically affected by this state of things were the best parties to suggest a remedy for them.

The Chairman said there had been some little difference of opinion amongst them that evening, which it was at all times desirable to see, for without it there could be no discussion. But the time now warned him that it was his pleasing duty to call their attention to a subject upon which he felt quite sure there would be no difference of opinion whatever, that was, to propose that they should join in a unanimous vote of thanks to Professor Levi, whose able paper they had listened to with so much pleasure, and which had been the occasion of so much interesting discussion. Professor Levi had been for a very long time distinguished and well-known, not only to the legal but also to the commercial world, for the great zeal, ability, and knowledge he had brought to bear, more particularly upon the subject of commercial law; and lawyers, merchants, and generally all who were interested in the progress of literature in its most useful departments, were very much indebted to him for his works, and might read them with great attention and profit. He (the chairman) hoped that he would contribute in future years much for the benefit of the community with regard to the amendment of commercial law. He would express a hope that no one present would imagine that any branch of the law was beyond the capacity of a well-educated mind, or a mind that had had experience in the ordinary transactions and business of life. Let them not be deterred by the uncouth and technical phraseology in which matters of law were frequently found to be worded. As soon as this was removed the law of England, which might be regarded as the mere expression of good sense, would be found to be intelligible to all. In conclusion the chairman proposed a cordial vote of thanks to Professor Leone Levi for his paper.

The vote of thanks having been passed,

Professor Levi said the discussion which had taken place upon his paper had afforded him considerable gratification, and he felt flattered by the reception it had met with. He hoped this discussion would not be without its practical results. He had reason to believe that her Majesty's Government were preparing to introduce a bill into Parliament to empower her Majesty to conclude treaties with foreign powers with the view to sustain the international right of trade marks. He hoped that bill would be speedily introduced, and that some sound practical legislation would take place upon it.

Professor Levi illustrated his paper by numerous specimens of fraudulent Trade Marks, and Mr. John Leighton, F.S.A., exhibited an extensive series of genuine Trade Marks, principally designed by himself, and in use by members of the book trade,

The Secretary called attention to a simple and cheap apparatus for showing some of the phenomena of polarized light, exhibited by Mr. Bestall.

The Secretary announced that, on Wednesday evening next, a paper by Dr. J. Forbes Watson, "On Cotton in India, its present Culture and Manufacture," would be read.

The following letter has been received by the Secretary since the meeting:—

Sir,—I was unwilling to protract the discussion last night after the able and lucid observations of the learned chairman and the numerous practical and useful remarks of subsequent speakers, or I should have made a few observations upon the paper of Professor Levi. This may, therefore, as well be done in the pages of the *Journal*, as the full ventilation of the subject is the great object aimed at. The importance of maintaining our supremacy in the quality of our goods and manufactures, and preserving to the manufacturers that proprietary right in their trade marks which their skill, industry, and outlay entitles them to, cannot be overrated. Our manufactures are sent to the uttermost parts of the earth, and it is the superior quality of the article, and the skill in the manufacture, which has enabled us to secure the trade and maintain a good name in the markets of the world. But, unfortunately, with our free-trade principles, and our striving after cheapness to meet the competition of foreign countries, there is a degree of lax morality gaining ground, and a deterioration in the quality of many of our principal articles now common which was not wont to be so. In olden times the trade guilds and corporate bodies looked especially to the maintenance of the high character of the workmanship in our broadcloths, our cutlery, and hardwares, and other principal manufactures of the country. The crafts and mysteries were then, at least, of some use, and although these close monopolies would not find favour in the present day, we have at least lost something by the absence of supervision and careful tests, and examination of the quality of work turned out. With the exception of the Goldsmiths' Company, and the Apothecaries' Company in London, and the Cutlers' Company of Sheffield, I am not aware of any other existing chartered body exercising a control over our articles of trade.

There may be some difficulties in the carrying out of any penal law respecting the infringement of trade marks and special proprietory articles, but these are not insuperable; and the effort is worth attempting—especially if it be combined with an earnest endeavour to improve, at the same time, the morality of trade. Trade carried on at the expense of another's good name, or under fraudulent pretences, and under the cloak of another's established reputation, is merely swindling, sheltered by the imperfection of the statute book.

The establishment of a public registry office, like the Joint-Stock Act, or Patent Office, for the registry of trade-marks upon payment of certain fees, seems feasible enough, and would confer a proprietary right in any mark, character, device, symbol, or monogram so registered. A dozen John Smiths, or Tom Browns, might here have their marks recorded, so that they were different and not too close an assimilation to previously recorded ones, to lead to confusion or fraudulent assumption. If the Crown has its distinguishing broad arrow, and its yellow thread in cordage, &c., to use or imitate which is felony, the manufacturer may, in the same manner, combine a symbol with his name, so as to give him a broad and distinct identification. Many printers, publishers, paper-makers, and artists, already use a monogram or device, even as many manufacturers now adopt a trade-mark, and the practice would soon become general when it was found to be beneficial. Piracy and highway robbery are justly reprobated and punished by every civilized nation, and the piracy of one's trade-mark, and the filching of the good name of another for personal interests and dishonourable purposes, are equally deserving of reprobation and punishment.

The earliest case in the English books is, I think, one that was decided in the time of Elizabeth, Southern *v.* How (*Popham's Reports*, 144), and is thus reported:—"An action upon the case was brought in the Common Pleas by a clothier; that whereas he had gained great reputation for his making of his cloths," (shoddy and mungo were not known then) "by reason whereof he had great utterance, to his great benefit and profit; and that he used to set his mark to his cloth, whereby it should be known to be his cloth; and another clothier foreseeing it, used the same mark to his ill-made cloth, on purpose to deceive, and it was resolved that the action did lie."

The rigid enforcement of the law against counterfeiting trade-marks is essential, not only to the pecuniary interests of merchants and manufacturers, but also to the sanitary interests of the public. Strong efforts have been lately made to abolish the supervision of herring curing in Scotland, and the impress of the official brand on the casks, which is the guarantee of the quality and goodness of the fish, and the criterion upon which a ready and unquestioned sale is obtained over nearly all the Continent for so many hundred thousand barrels. The fishermen would no doubt much prefer to shovel into the barrels any kind of fish, whether properly cured or not, quite regardless of the present effects at the Continental towns, where the brand has been the sure passport of excellence, or the future effects on the trade. So with mess pork and beef, and cured provisions generally. Again, the brand of the inspector on the flour barrel, coupled with the trade mark of the manufacturer in Canada, or the States, is the guarantee to the purchaser of the soundness of the flour contained, whether it be the "common State," "extra," or "superfine" quality.

The chairman mentioned several cases of the substitution of false inferior wines and liqueurs for well-known superior qualities. But this fraudulent principle is carried out to a large extent. Empty brandy casks and bottles with well-known marks are bought and filled in the docks, and in Holland, &c., specially for export, with the vilest trash. In London, not long ago, there was seized a large quantity of spurious ale, which, whether *pale* in itself or not, was pretty likely to impart that hue to imbibers. It contained very vile ingredients, and the bottles, fraudulently labelled "Allsopp's Ale," were about to be exported to the United States. The manufacturers were prosecuted for counterfeiting the trade-mark, and sentenced to twelve months' imprisonment with hard labour. Only a few days ago, a Mr. Anderson was held to bail in the Marylebone police-court, to stand his trial for fraudulently making use of the casks and trade-marks of the proprietor of Thorley's Cattle Food, for the disposal of a compound of his own, with intent to deceive, thereby injuring the original proprietor.

In an action, Allcroft *v.* Culverwell, heavy damages were recovered for the fraudulent use of the trade name "Dent and Co.," in red ink on gloves, although the plaintiff only so impressed the right-hand glove, while the defendants stamped both gloves, and also stamped the word "Company" in full.

In America the Amoskeag Manufacturing Company filed a complaint and obtained an injunction in 1849, against Spear and Ripley, to restrain them from using their trade-marks on tickings. The mark was an oval, with the letters A. C. A. below the centre, and surrounded by a vignette in red. The motion to dissolve the injunction was argued and denied in 1849, the judge, however, reserving the question of the right of the company to the letters A. C. A., unless united with the vignette.

Subsequently a decree was made establishing the right of the company to the whole trade-mark, and also to the letters "A. C. A.," whether in combination or by themselves. The plaintiffs waived the claim for damages.

In the Supreme Court of Calcutta, in November, 1854, John Leech *v.* Doorgachurn Seal and another. This was a suit by Mr. Leech, of Staleybridge, to restrain the defendants from using a fabricated mark for stamping grey shirtings of an inferior character, so as to lead persons to believe they were genuine. The bill sought delivery up of the false stamp, an injunction as to selling shirtings so stamped, and an account of the profit made already by such sales.

It was given in evidence that the imitation of English trade-marks in Calcutta had been carried on to a considerable extent. It appeared that Mr. Leech sent out to his correspondents there two classes of shirtings, one made by himself and marked A., and called the "Company's mark shirtings," the other marked A. B., and called "Imitation Company's mark shirtings." The defendants, by a forged stamp, had endeavoured to give the first-class character to the second-class cloth, and carried on a large and profitable trade for some time in this manner. The decree was for a perpetual injunction with costs.

Almost every article of merchandise possessing a high reputation in Europe is extensively imitated in America. Being apt and cunning, the universal Yankee nation tries its hand, and hence we have counterfeit Heidseck champagne, Piesse and Lubin's extracts, Rodgers' cutlery, Cognac brandy, Worcestershire sauce, Belgium cloths, Burton ale, Irish linen, French silks, Scotch shawls, and a thousand other things manufactured in the States, and sold as the "real genuine originals."

It seems to be generally understood there, that where a foreigner has no patent-right the public is free to compete with him, and some go so far as not only to imitate his manufactures, but copy, if desirable, his labels and trade-marks. At the same time everybody is aware that the imitator of labels and trade-marks may, if the injured party choose to invoke the law, be restrained by injunction, and mulcted in such damages as the original proprietor or maker can prove he has sustained. In 1845, a law was passed through the New York Legislature, making it a penal offence, punishable by imprisonment in a county jail, to imitate private stamps or labels, or to vend any goods having thereon such imitations. In 1850, this Act was amended, by adding thereto a section making the party having "in his possession any die, plate, engraving, or printed label, stamp, or wrapper, representation, likeness, similitude, copy or imitation of the private stamp, wrapper, or label for the purpose of assisting in the sale of imitated goods, &c.," equally guilty with the manufacturer and vendor, and subject to the same punishment. Under this Act the agents of foreign houses have frequently made strenuous efforts to procure indictments by Grand Juries, but with very little success. Under the various bills that have been found, I am not aware of more than two or three convictions, and I believe in neither case has the Court imposed anything beyond a nominal punishment.

In 1850, Lea and Perrin, proprietors of the Worcestershire sauce, sent over and brought a suit against a man in New York, who, in connection with his pickle and preserve business, was manufacturing the article and selling it by the name and style of the original. They alleged that he had forged their labels; and, not content with the injunction, which most effectually stopped the pretended counterfeit, nor satisfied with the suit at law for damages, they had the man indicted under the act abovementioned, and brought up at the Sessions for trial. He was acquitted. In 1854, a German merchant was tried there for counterfeiting the labels of a certain brand of wine, and convicted. The evidence was so full and clear that the jury could not get rid of the verdict, else I fancy they would have promptly set the prisoner free.

In Hunt's *Merchants' Magazine* of New York, a publication in which some excellent articles on this subject have appeared, it is well remarked that the trade-mark adopted by a foreigner is an announcement to the world that he has made, or selected for market, the article to which such trade-mark is attached. The article itself may be imitated in the United States by any one without interference. But he who simulates such trade-marks, and passes off his own wares for another's, is guilty of a fraud which is cognisable in the courts of every civilised land, because it is contrary to that natural justice which is the foundation of all law. There seems, however, to be no copyright in names or titles, and great ingenuity is frequently displayed in ringing the changes upon a name that has become popular, or that takes with the public. Thus, beside the Bank of London we have the Union Bank of London, the Western Bank of London, and so on. Is the *Monthly Magazine* or *Quarterly* popular? Out comes the *New Monthly* and the *New Quarterly*. Have *Bell's Messenger* and the *Illustrated News* achieved a large success? Forthwith the *New Bell's Messenger* and the *Illustrated News of the World* attempt to share in the profits and popularity so acquired, even if it be by taking offices next door, further to carry out the simulation. The Bank of Australasia having acquired a large business connection in the southern colonies, a local Bank, under the title of the Colonial Bank of Australia was projected and carried out by a friend of my own in Melbourne. An action was brought in the local courts by the Bank of Australasia to prohibit the use of the name, as an infringement and a deception. But they were nonsuited. A parallel case occurred to myself in the adoption of titles. My friend, Mr. Montgomery Martin, projected and carried on the *Colonial Magazine* for some years, but owing to differences with his publishers (who had an interest in it) he seceded from it, and the publication was dropped. Messrs. Fisher and Co. thereupon brought out a new issue, under the title of *Fisher's Colonial Magazine*. Subsequently they advertised the property for sale, and I agreed to purchase it of them, but they stated they could not guarantee me the copyright, as Mr. Martin might bring an injunction. Upon consultation with my solicitor, I found I could however bring out such a publication by adding the prefix, *Simmonds's Colonial Magazine*, and by this means I saved the purchase-money asked by Messrs. Fisher.

In 1855 an action was brought by the Traveller's and Marine Insurance Company against the Marine and General Traveller's Insurance Society for an infringement of the title and the copyright of their tables. The argument set up seemed to be, I may keep a Red Lion, but you must not set up another. You must not even keep a white, a yellow, or golden lion, for that would be a colourable imitation. The trial resulted in a verdict for the defendants, the learned judge considering there was no property in the title, and no damage was shown, The observations on this subject, made by Mr. James Wilson, of Sheffield, in his paper on cutlery, &c., before the Society—(*Journal*, vol. iv., p. 360)—are deserving of being reproduced at the present time, as they have a practical weight and bearing:—

> "It may be pernicious for our rulers to interfere, and dictate as to the mode of conducting a business; but it would not be out of the province of government to restrain and punish fraudulent transactions. A very simple law might be passed rendering it compulsory on every manufacturer to strike some distinctive or distinguishing mark on all his goods. That would all be that is required to give every honest manufacturer all the protection he needs, and it would be ample restraint upon the dishonest, who trade by systematic imposition. Every printer or publisher is required legally to print his name or an equivalent upon his issues. Why should not every manufacturer be compelled to do the same thing in effect? To strike his name merely would be insufficient, as names are common property. But a distinctive mark ought to be compulsory to protect the honest and punish the dishonest trader. There is a common fallacy respecting striking *names*. It seems to be held that a man's *name* is his *mark*. It would be if no two men had the same name. But so long as names are common, common names cannot form distinctive marks."
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> "No doubt one Smith has as good a right as the other Smith to place his own name on his own productions. But doing so with a view to dispose of his productions, as those of another man, ought to be a legal offence, as much as it is a moral one. If the Smith of imposture wished to preserve his mark as a distinction in trade, let him have a *distinguishing mark*. If he wished to raise for himself a trade, it would be to his advantage that his goods should be unmistakeable. But when he insists upon using a mark which he knows belongs to another, and has a market value, it is evident that he has a dishonest intention. Against that intention I think it is the duty of the legislature to provide protection, both on behalf of the public, and in justice to the honest manufacturer. For these reasons, then, I would render it compulsory upon every manufacturer to use a distinguishing mark, other than his name. I think it would prove the surest check upon the production of spurious goods, and, at the same time, offer every inducement to the manufacturer to make the best articles. I am aware that it is actionable in a court of law to piratea mark, but it is evaded by the intervention of men of straw, against whom it is certain loss to proceed, for they exist in such abundance, and having nothing to lose, they

almost bid defiance to the law. Let it be made felonious to forge a mark, as it is to forge a signature, and there will be but little inducement to rob a manufacturer of his honest name. I should have but little confidence in any remedy that did not go to this extent; and I trust the manufacturers of this country will take up the question with the earnestness that the case demands."

In conclusion, I may state, that no one who regards honesty and fair dealing will say that any manufacturer has a right to license another to strike his mark and use his labels, or that any manufacturer does right who strikes on his goods any marks or names his customers may direct. The more stringent the practice with regard to pirated marks and labels, &c., the better it will ultimately be for the trade and reputation of the country; the old adage of honesty being the best policy is certainly true. I am, &c.,

PETER LUND SIMMONDS.

8, Winchester-street, S.W., March 17th.

Home Correspondence.

EXHIBITION OF 1861.

Sir,—Should there be a decision in favour of attempting a second Great Exhibition in London in 1861, it cannot but be desirable that some definite and regular plan, embracing the whole subject, should be submitted, discussed, and well digested, and afterwards put forth as, to a certain extent, final, for the benefit both of those who are to exhibit and those who are to manage the Exhibition. The existence of some such scheme is as necessary now as it would have been impossible before, for the experience of the first Exhibition should not be lost, and without experience of that kind no one could possibly anticipate either the nature or extent of the work to be done. It has occurred to me that a few remarks at the present time may be useful in directing attention to the machinery that will be required in the first organisation of this great work, if it is to be undertaken with a prospect of success.

In the first place, I would remark that many of the peculiarities that rendered the Great Exhibition of 1851 exceedingly effective, and were even in some respects valuable, must, in another Exhibition, be carefully avoided; I mean the incessant repetition of groups of similar objects in different parts of the building, the great want of balance in many departments, the general absence of a principle of arrangement, and the almost fantastic character of the whole collection. In a future Exhibition there should be more order and system, better means of comparing and contrasting; much rubbish must be got rid of, and the various objects exhibited should be, to some extent, in regular series. Different countries could hardly with advantage be left to disport themselves at pleasure in the space allotted to them, even if it were thought desirable, in all cases, to place the objects sent by particular countries in one group. Time should be allowed for securing to every country and every department its due place and the quantity of room it needs.

To bring about this result, it seems desirable to obtain, as soon as possible, an outline of the proportionate value of various departments from those whose experience and knowledge may enable them to judge, and who are willing to assist. Volunteers might readily be found for this work, and the different reports might be brought into harmony in a short time. The classes which formed the basis of arrangement in 1851, and which, on the whole, were found admirably adapted for their object, might serve as the foundation, but might probably be found to admit usefully of certain modifications. Lists of objects might be prepared more or less in detail, and these should include not only those formerly exhibited, but those which were absent and ought to have been present. Lists, as complete as possible, of raw materials and articles in various stages of manufacture, should be made out, together with suggestions as to whence the raw materials should come, in what state they should be sent, what dimensions they should have, their value at first hand, and the additional value put upon them before they enter different markets, the duties to which they are subjected, and the probable extent to which they could be supplied. All these, and many other facts should be objects of inquiry, and knowledge concerning them should be obtained of an authentic kind. Similar inquiries should be made in reference to the various objects manufactured. In many cases the different accounts that would come from different districts would be highly suggestive and valuable for comparison; but, at any rate, a vast amount of information would thus be obtained beforehand, and arrangements could be made for doing justice to every department.

It seems to be recognised that a new Exhibition should be one showing progress. To ensure this, also, much preliminary consideration would be necessary, and the nature of the progress ought to be clearly set forth in every case beforehand, as far as an idea of it can be obtained from those who are supposed to be the best authorities in their respective departments. In this way alone can progress be effectually shown. An exhibition of progress is, however, almost impossible without definite means of comparison, and the mode in which this can be managed requires serious consideration. Some attempt at a systematic serial management seems to be absolutely indispensable, but those only who attempted this at the last Exhibition can be aware how much preliminary work is needed even to make an attempt in this direction.

If, however, as is probable, all parties would unite a sufficient time beforehand to help in the formation of definite plans, a vast amount of confusion and derangement would be prevented. It is chiefly with a view to make this suggestion that I venture to ask you to insert these remarks. I think there is no doubt that, if properly conducted and successful, a Great Exhibition of progress in 1861 would be, at least, as useful and important, if not as startling a novelty, as that of 1851, and it might in that case be the origin of a series of exhibitions, the effect of which on English art, English taste, and English manufacture, no one can foresee. That it would be in the highest degree sound and beneficial cannot, however, admit of a doubt. I am, &c.,

D. T. ANSTED.

PRODUCTS OF THE COMBUSTION OF COAL-GAS.

Sir,—The letter of your correspondent, Mr. Taylor, in to-day's *Journal*, has brought to my notice a communication from Mr. Evans, concerning the remarks I have made on the terribly mischievous effects of the combustion products of coal-gas; and, as the tenor of that communication is to show that the fears which I may have excited are groundless, I venture to trouble you with the data upon which my opinions are founded.

1. It is well known to chemists that coal-gas invariably contains a large quantity of sulphur.

2. It is also well known that sulphur in the act of burning becomes sulphurous acid, and this, by subsequent oxydation, is always converted into sulphuric acid.

3. The quantity of ammonia in coal-gas, even if the alkali were not destroyed by combustion, is never anything like sufficient to neutralise the sulphur acids which are formed.

4. Analyses made by me, almost daily, for many years, have never failed to discover the presence of sulphuric and sulphurous acids in the products of gas combustion.

5. It is a matter of common observation that the products of the combustion of gas rapidly destroy all kinds of textile fabrics.

Now I think it is unwise on the part of gas manufacturers to deny these facts, or to endeavour to hide them in a multitude of words; for I am convinced that it is to their interest to meet them openly, and to endeavour to find a remedy for them.

That sulphur is present in coal-gas to a large amount cannot be doubted. I have, in fact, found that the average quantity is about 200 grains per 1000 cubic feet of gas; but Mr. Lewis Thompson, who is quoted by Mr. Evans as a conclusive authority in this matter, says that it rarely falls short of 1,191 grains[*]—a quantity that is sufficient to produce rather more than half a pound of the strongest oil of vitriol of English commerce; and that Mr. Lewis Thompson has always regarded this as a serious impurity is evident from his many allusions to the subject;[†] indeed, he has rallied me in one of his criticisms, by saying, "If Dr. Letheby had wished to investigate the purity or impurity of the Central gas, he ought to have attended most minutely to the quantity of bisulphuret of carbon contained in it; for this is, after all, the only thing in ordinary coal-gas worth calling an impurity."[‡] It may, therefore, be considered as a settled fact, that coal-gas always contains a large amount of sulphur.

As to the second question, there can also be no doubt; for sulphur in the act of burning invariably produces sulphurous acid, which rapidly absorbs oxygen, and becomes converted into sulphuric acid. This is so far an established fact in chemistry that it need not be discussed.

With regard to the third point, viz., the presence of ammonia in coal-gas, upon which so much stress is often laid, a few figures will show that the proportion of alkali is never sufficient to neutralise the acid formed. Mr. Wright, who is one of the greatest authorities in the matter of coal-gas, says that the quantity of ammonia in raw gas, "even when no means other than the condenser have been taken to remove it, does not exceed the one-two-thousandth part of the whole bulk; and so sensitive is the turmeric test of the presence of anything approaching to this quantity, that it is instantly detected by the change in colour from yellow to deep red."[§] Now this quantity, which may be regarded as the maximum, is just 158 grains per 1000 cubic feet of gas; but the acids formed by the combustion of the 200 grains of sulphur in that quantity of gas require 212 grains of the alkali for neutralisation, and Mr. Thompson's proportions (1191 grains) of sulphur would require 521 grains. It must be remembered, however, that the amount of alkali here mentioned is that which is found in unpurified gas. The gas of commerce contains a much smaller proportion; indeed, Professor Graham said, in his evidence before the Parliamentary Committee on the Great Central Bill, that one part of ammonia in 52,000 of gas was a large proportion[||]—a quantity that amounts to only about six grains per 1,000 cubic feet. And then, again, it must not be forgotten that it is a property of ammonia to be destroyed by heat, so that, even of these six grains of the alkali, little or none can escape through the flame of the burning gas to be available for the neutralisation of the sulphur acids. Looking, therefore, at this part of the subject, it is manifest that the acids cannot be neutralised by the alkali present in the gas.

4th. Whoever will take the trouble to analyse the products of the combustion of coal-gas, will find abundance of the sulphur acids in them. Let him do as Mr. Taylor has done,[*] burn coal-gas under a glass bell, or under a glass vessel containing water, and, in a short time, the oil of vitriol will trickle down and hang in drops upon the glass. I have in my laboratory a glass retort, under which gas is constantly burning at the rate of about one cubic foot an hour, and I have never yet seen it free from sulphuric acid—ounces, in fact, have dropped from it; but this does not represent more than a small fraction of that which has escaped and found its way into the atmosphere, and thence into the pores of delicate fabrics. To recognise, therefore, the total amount of sulphuric acid which is produced by the combustion of gas, especial contrivances must be used; and here it is that all the quibbling arises. I am charged with *making* oil of vitriol, as if I did anything more by my process than is done in nature in a slower way; for sulphurous acid,—the first product of the combustion of the sulphur of gas,—cannot remain in the presence of atmospheric air without becoming sulphuric acid; and by my process I merely anticipate this change. Again, it is said that so much water is formed during the combustion of gas, that *strong oil of vitriol* cannot be produced; but who does not know that the weakest solution of sulphuric acid will soon become concentrated by evaporation; and that which is produced by the condensation of aqueous sulphurous acid from the burning gas, is speedily dried into corrosive oil of vitriol. This, in fact, is the true cause of all the mischief to textile fabrics. Dr. Normandy, like Mr. Taylor and myself, has put this to the test of experiment, and has corroded things with it; he has collected sulphuric acid from the aqueous products of burning gas, and has proved its destructive quality; but he adds, in his account of the matter, "that there is considerably more sulphuric acid eventually produced by the combustion of gas than can be detected by this method of analysis, since it only takes into account the almost insignificant quantity of sulphuric acid formed at that period (when the gas is burning), but fails in arresting the sulphurous acid, which in reality, by its subsequent spontaneous oxidation, is the chief cause of the mischief complained of."[†] This, in truth, is the unqualified opinion of everyone who has directed his attention to the subject; and I might weary you with quotations in proof of it. Dr. Taylor says:—"There is no process known by which coal gas can be entirely freed from the vapour of bisulphuret of carbon. It is owing to the presence of these bodies that coal gas, while burning, produces sulphurous acid, which is not only offensive to respire, but very injurious to furniture."[‡] To the same effect are the remarks of Dr. Prout, Dr. Frankland[§], Dr. Griffin,[||] and many others. Even Professor Faraday, who is reported to have said that he thinks very little of the sulphurous acid formed by coal gas, has also found it necessary to construct a means of carrying the products of combustion out of the Athenæum library; and I hold in my hand a copy of his evidence before the Athenæum Committee, in which I find that, at a subsequent meeting of the Committee, he stated that "he had examined two of the books from the library, and the quantity of acid present in the backs of them surpassed his expectations. They tasted strongly of acid, which was in a free state; and there was not the same quantity of acid in the leather obtained from the binder as in the books referred to." Mr. Aikin, who was also in opposition to Dr. Prout at first, observed the same fact; and, in the end, both he and Mr. Faraday agreed with Dr. Prout, that for the safety of the books it was necessary to carry the products of the combustion out of the room.

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[*] I quote from a somewhat playful critique of his, on Mr. Leigh's analysis of coal-gas, wherein he says that bisulphuret of carbon is a "constant ingredient of coal-gas," and that "it seldom contains less than one-thousandth of its bulk of the vapour of bisulphuret of carbon."—*Journal of Gas Lighting*, vol. ii, p. 205.

[†] Vide pages 358, 434, 474, of vol. ii. of the *Journal of Gas Lighting*, and pages 29, 78, 178, 262, 362, 455, 473 of that journal.

[‡] *Journal of Gas Lighting*, vol. ii., p. 358.

[§] *Journal of Gas Lighting*, vol. i., p. 13.

[||] *Journal of Gas Lighting*, vol. ii., p. 277.

[*] *Journal of Society of Arts*, vol. vii., p. 258.

[†] *Journal of Gas Lighting*, vol iii., p. 302.

[‡] *Pharmaceutical Journal*, vol. viii., p. 137.

[§] *Journal of Gas Lighting*, vol. ii., p. 126.

[||] *Pharmaceutical Journal*, vol. xvi., p. 166.

Lastly. What answer can be given to the experience of those who have used gas to any extent in their houses, or how can any number or form of words explain away the evidences which were submitted to the Society at the reading of Mr. Leighton's paper. If ever the relation between cause and effect was fully established, it is so in the case before us, and nothing but the most determined unbelief would hesitate to admit it.

I am, &c.,
HY. LETHEBY.

London Hospital, March 11, 1859.

SIR,—Having read with much pleasure the interesting paper of Mr. Leighton and the several letters which have appeared in the *Journal*, I believe it my duty to state that there cannot be a doubt on the subject of the combustion of gas being a source of serious injury to the binding of books in public libraries; and some of the facts stated by Dr. Letheby, in his valuable letter, were noticed by me in an examination which I made of decayed bindings in some of the public libraries of this city; and my observations were published in a notice which appeared in the *Transactions of the Society of Arts*, vol. 57, page 120, 1851. I am, &c.,

F. CRACE CALVERT.

Royal Institution, Manchester, 10th March, 1859.

MUSEUM OF PATTERNS AT STUTTGART.

SIR,—The enclosed paper is an extract from Councillor Wichgraf's (of Potsdam) Report on the state of industry in Wurtemberg and Switzerland in the year 1857. I think the feature of circulating patterns among manufacturers and others through the medium of public museums, is worthy of being brought before the public, in the interest both of consumers and producers in this country. I am, &c.,

A. TOLHAUSEN.

London, Feb. 7, 1859.

"Before all, I have to mention the fine collection of patterns exhibited by the Royal Board of Trade and Commerce, and containing exceedingly fine, rich, and manifold patterns of all branches of home industry, of raw materials, and of the principal branches of industry abroad, especially of France and England. This collection is continually provided with new products, models, samples, &c., and is open to tradesmen and manufacturers at all times. The great exhibitions in London, Munich and Paris, have been largely taken advantage of, by purchases having been made of many articles exhibited at those places, and particularly of synoptical and systematical groupings of various products of industry. The administration (in 1857) was engaged in providing more spacious rooms and better light for this collection, which increases rapidly.

Connected therewith there exists a considerable industrial library, containing the chief technical works, periodicals, journals, drawings, &c., (amongst others a complete set of the specifications of inventions patented in England). Books are moreover exhibited here, which contain a great variety of Paris patterns of new silk, woollen, cotton, and other fabrics, from which visitors are allowed to cut off small patterns. The public avail themselves of that permission to a great extent, since of many patterns only a small remnant with the affixed label is left. At any rate that mode of using patterns is far preferable to a mere inspection of the books, since most of these articles, being of an ephemeral character, require to be quickly made use of.

"This museum is not only intended to promote the higher education of tradesmen, but also to give to the commercial world, both at home and abroad, the best information about the chief industrial products of the country.

"The annual number of visitors to that museum amounts to many thousands; and, besides, many thousands of patterns are lent out by the administration to manufacturers all over the country. This shows best that this institution is of a practical nature, and is highly valued by manufacturers and tradesmen."

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Rev. Henry Christmas, "On Shakspeare's Historical Dramas."
Brit. Architects, 8.
Medical, 8.
United Service Inst., 8½. Major G. Rhodes, "On Tents and Tent-pitching."
TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. Mr. M. B. Jackson, "On the Melbourne (South Australia) Gravitation Water Works."
Medical and Chirurg., 8½.
Zoological, 9.
WED. ......London Inst., 3. Mr. E. W. Brayley, "On Meteorology."
Royal Soc. Literature, 4½.
Meteorological, 7. 1. Mr. H. S. Eaton, "On some Atmospheric Conditions favourable to the Development of Ozone." 2. Dr. Smallwood, "On a remarkably cold period which occurred in Canada in January, 1859." 3. Rev. A. Wild, "The results of Meteorological Observations made at Stonyhurst Observatory during ten years."
Society of Arts, 8. Dr. Forbes Watson, "On Cotton in India: its present Culture and Manufacture."
Geological, 8. Prof. Huxley, 1. "On some Reptilian Remains from South Africa." 2. "On the Ramphorynchus Bucklandi." 3. "On the Dermal Armour of Crocodilus Hastingsiæ." 4. "On some Remains of Cetacea and Birds from New Zealand."
Archæological Assoc., 8½.
THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Force of Gravity."
Philosophical Club, 5½.
Numismatic, 7.
London Inst., 7. Professor Bentley, "On Vegetable Substances used for the food of man."
Antiquaries, 8.
Philological, 8.
Royal, 8½.
FRI..........United Service Inst., 3. Lieut.-Col. McDougall, "On the Military Character of the Great Duke of Marlborough."
Royal Inst., Meeting, 8. Lecture 9. Dr. R. A. Smith, "On the Estimation of Organic Matter in the Atmosphere."
SAT. ......London Inst., 3. Mr. E. M. Brayley, "On Meteorology."
Royal Inst., 3. Dr. W. A. Miller, "On Organic Chemistry."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. NO.

Delivered on 26th and 28th February, 1859.

6. Railway and Canal Bills: 63, Norwich and Spalding Railway; 64, Norwood and Streatham Railway; 65, Oldham, Ashton under Lyne, and Guide Bridge Junction Railway (Contribution of Funds, &c.); 66, Oxford, Worcester, and Wolverhampton Railway; 67, Scottish Central Railway; 68, Sittingbourne and Sheerness Railway (Additional Capital, &c.); 69, South Durham and Lancashire Union Railway; 70, South Wales, Pembroke, and Tenby Junction Railway; 71, Stockton and Darlington Railway; 72, Swansea Vale Railway; 73, Tenbury Railway; 74, Tendring Hundred Railway; 75, Vale of Llangollen Railway; 76, Wandsworth and Putney Railway; 77, Warrington and Stockport Railway; 78, Wells and Fakenham Railway);—Board of Trade Reports.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 11, 1859.]

Dated 1st February, 1859.

290. G. A. Waller, Dublin—Imp. in the means of and apparatus for expressing liquid from semi fluid substances, and other substances containing liquid.

Dated 10th February, 1859.

380. B. Burrows, Leicester—Imp. in looms for weaving narrow fabrics.

Dated 16th February, 1859.

438. J. S. Benson, Birmingham—A new or improved method of silvering glass. (A com.)

Dated 19th February, 1859.

1466. R. A. Brooman, 166, Fleet-street—Imp. in machinery for doubling threads. (A com.)

Dated 21*st February*, 1859.

476. A. Taperell, 37, Moorgate-street—Imp. in compositions or compounds used when cleaning glass.
478. J. Schloss, Cannon-street—An imp. in locks or clasps for porte-monnaies, pocket books, bags, and other like purposes. (A com.)

Dated 22*nd February*, 1859.

488. W. Gossage, Widnes, Lancashire—Imp. in the utilization of alkali waste.

Dated 23*rd February*, 1859.

490. S. Ridge, Hyde, Chester—Imp. in coupling or making the joints of pipes and other articles.
492. G. Davies, 1, Serle-street, Lincoln's-inn—Improved apparatus applicable to the evaporation of saccharine liquids, and for the concentration of heat for other purposes. (A com.)
494. W. Sharp, Bingley, Yorkshire—Certain imp. in machinery for spinning and twisting worsted, cotton, silk, and other fibrous materials.
496. S. Russell, 12, Sheaf gardens, Sheffield—An imp. in the manufacture of handles for tea and coffee pots, jugs, pestles, knives, daggers, and forks, or any description of article to which handles are applied.

Dated 24*th February*, 1859.

499. J. Robinson, Lower House, near Burnley, Lancashire—Imp. in machinery and apparatus applicable to machinery for spinning and doubling.
500. R. Mnshet, Coleford, Gloucestershire—A new metallic compound or alloy.
501. R. Mushet, Coleford, Gloucestershire—An imp. in the manufacture of cast steel.
503. J. Crosland, Crosland-moor, Huddersfield—Imp. in looms for weaving textile fabrics.
504. A. Lançon, jun., Besançon, département du Doubs, France—A new system of watches.
505. J. H. G. D. Wagner, Paris—Apparatus for cleaning water, and removing all matters in suspension and dissolution contained in it, water intended to feed generators of all sorts (applicable also to other purposes), which besides previous to its getting into the generators, is heated to the highest degree without almost any expense.
506. J. Dale, Cornbrook, Manchester—Imp. in concentrating caustic alkalis, and in applying a product therefrom to the purpose of obtaining motive power, and to other purposes.
507. E. Price and E. Hawkins, Doncaster—Imp. in the mode of forming fish plates, and in the method of fixing or attaching them to the joints of rails on railways.
508. A. C. Kelly, Silchester-road, Notting-hill—Imp. in apparatus for drawing off fluids.

Dated 25*th February*, 1859.

509. A. Reid and R. Tonge, Manchester—Certain imp. in weaving, and in the machinery employed therein.
510. A. Reid and R. Tonge, Manchester—Certain imp. in or applicable to looms for weaving.
511. T. C. Hinde, Dudley, Worcestershire, and G. J. Hinde, Wolverhampton, Staffordshire—Imp. in coating iron with copper or alloys of copper.
513. W. McNaught, Manchester—Certain imp. in steam engines, particularly applicable to compound steam engines.
514. R. Fielden, jun., and T. Fielden, Walsden, Lancashire—An imp. or imps. in the manufacture of pickers to be used in looms for weaving, and also in the machinery or apparatus to be employed in the manufacture of the same.
515. J. Reddie, Colehill-lodge, Fulham, Middlesex—An improved mode of propelling and steering vessels.
517. W. Clark, 53, Chancery-lane—Improved apparatus for spinning, twisting, doubling, and drawing fibrous materials. (A com.)

Dated 26*th February*, 1859.

518. F. Weekes, Bolney, Sussex—The treatment of certain alcoholic products.
519. G. Earnshaw, Horbury, near Wakefield—The treatment of woollen and other rags and waste of fibrous substances, so as to obtain useful products therefrom.
520. J. Lee, Saint Helen's, Lancashire—Certain imp. in ploughs.
521. J. Hine, Clerkenwell—An improved joint for cabinet making, carpentry, and other constructive purposes.
522. W. Burgess, Newgate-street—An imp. in reaping and mowing machines.

Dated 28*th February*, 1859.

523. E. Gatwood, Great George-street, Westminster—Imp. in buffing traction and bearing springs, applicable to railway carriages and locomotive engines.
525. A. Martin and A. Crichton, Pollokshaws, Renfrew—Imp. in weaving and woven goods.
526. J. Howden, Glasgow—Imp. in machinery or apparatus for cutting, shaping, punching, and compressing metals.
527. J. Leigh, Manchester—Imp. in the purification of coal gas.
528. G. Horner, Falls-road, Belfast—Imp. in hackling flax, and other fibrous materials, and in machinery for the same.
529. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for stopping horses. (A com.)
530. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for taking soundings, applicable also to the throwing of life lines. (A com.)
531. C. Hall, and C. Hall, jun., Navestock, Essex—Imp. in steam agricultural machinery.
532. A. Turner, Leicester—Imp. in the manufacture of elastic fabrics.
533. A. V. Newton, 66, Chancery-lane—Imp. in constructing and working condensing engines. (A com.)
534. W. Hodson, Kingston-square, Hull—Imp. in rotary engines.
535. R. Brown, Earith, near Saint Ives, Huntingdonshire, and W. Milne, Bushey, Hertfordshire—Imp. in firearms.

Dated 1*st March*, 1859.

537. T. Cloake, 6, Saville-row, Walworth, Surrey—Stopping of the bodies and wheels of railway and other carriages.
538. J. Holroyd, Leeds—An imp. in finishing woollen cloths and cloths made from a combination of wool and other materials.
539. Rev. H. Moule, Fordington, Dorsetshire—Imp. in apparatus applicable to the evaporation of sewage or other waters, and for affording heat for other uses.
540. J. Wetherilt, Chapel-street West, Mayfair, Middlesex—Certain imp. in locks.
541. J. Edwards, Fenton, Staffordshire—Imp. in stacking or holding biscuit, earthen, china, and glossed ware for firing.
542. G. P. Rivers Baron Rivers, Rushmore-lodge, Wiltshire—An improved implement for breaking up and preparing land.
543. J. Templeman, Glasgow—Imp. in the manufacture or production of artificial fuel.
544. J. Pile, West Hartlepool—Imp. in the construction of floating docks.
545. D. Lichtenstadt, 1, Henry-cottages, Park-road, Peckham—Converting certain vegetable substances into fibrous material for the manufacture of paper, textile, and other fabrics.

Dated 2*nd March*, 1859.

547. P. Currie, Birmingham—Certain imp. in spindles for locks, latches, and other door fastenings.
549. J. M. Adams, D. Law, and J. Inglis, Glasgow—Imp. in fire places, grates, ranges, and stoves.
551. W. F. Dearlove, 10, Dartmouth-street, Westminster—An improved chopping machine.
553. J. W. Harker, 24, Upper Barnsbury-street, Islington, and K. Field, Upper Marsh, Lambeth—Imp. in coating the bottoms of iron and other ships and vessels. (A com.)
555. C. Hill, Cheddar, Somersetshire—An improved construction of stay fastening.
557. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction of grease boxes and bearings generally. (A com.)
559. J. Newcomb and J. G. Lovell, Bristol—Imp. in obtaining and applying motive power, especially adapted, amongst other purposes, to the propelling of ships and vessels.
561. W. Brown, 4 and 5, Edgar-place, Mile-end—Imp. in the manufacture of pipe mounts or stems, cigar tubes, and similar articles.

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

569. H. Leonard, Massachusetts, U.S.—An imp. in the manufacture of paraffine candles.—3rd March, 1859.
570. W. Tucker, Massachusetts, U.S.—An imp. in bit stocks or augur handles.—3rd March, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, March* 11, 1859.]

March 11*th*.

2064. J. M. Courtauld.
2065. H. Page.
2069. L. Kaberry & T. Mitchell.
2074. C. W. Siemens.
2075. S. Hanbury.
2081. L. Vidie.
2090. F. Fowke.
2382. A. V. Newton.
2424. J. Drummond.
2456. P. A. Mawdsley.
2457. P. A. Mawdsley.
2667. R. H. Hess.
2862. J. Wade.
2878. T. Moss.
21. G. T. Bousfield.
94. J. Hands.

[*From Gazette, March* 15, 1859.]

March 15*th*.

2091. E. Smyth.
2093. W. G. Taylor.
2099. C. F. Vasserot.
2102. C. Hadley.
2105. J. Luis.
2115. E. Riepe.
2121. J. Bethell.
2127. J. Hope.
2139. T. C. Hinde.
2147. R. Bodmer.
2151. G. L. Turney.
2157. W. Clark.
2241. W. A. Munn.
2479. R. E. Pinhey and J. Wood.
2613. G. Howe and J. Norton.
2791. G. Snell.
53. E. Heywood.
93. J. Thomson.
207. C. Sharps.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March* 11, 1859.]

March 7*th*.

635. C. B. Normand.
762. C. B. Normand.

March 8*th*.

586. J. Davy and J. Milnes.

March 9*th*.

846. W. H. Gauntlett.
897. W. Smith.

[*From Gazette, March* 15, 1859.]

March 10*th*.

592. J. Fowler, jun.
598. E. A. Pontifex.
612. T. Porter.
619. W. Yates.
632. J. Pegg.

March 11*th*.

625. E. T. Wright.

March 12*th*.

618. P. Marcus.
622. C. Coates.

Journal of the Society of Arts.

FRIDAY, MARCH 25, 1859.

EXHIBITION OF 1861.

The following letter has been received from Sir Wm. Holmes:—

Sir,—Having been favoured with your circulars of 30th December, 1858, I venture to suggest that it would add much to the interest of the collections to be forwarded from the colonies, if the Fauna and Flora of the respective countries were added to the more utilitarian ingredients.

We will suppose the department to be allotted to British Guiana approachable through a grove of palms of various descriptions, and other characteristic plants, Some of our more remarkable animals, our many-tinted birds, butterflies, and insects, should be represented as naturally as circumstances would admit in this tropical grove. There, too, would appear orchids, ferns, sensitive plants, the pine-apple, sugar-cane—in fact, every procurable plant, indigenous to the locality represented, which would best and most peculiarly illustrate the place of its nativity.

Were it possible—and in these days all things are possible—the climate of the country should be in some degree represented, not only for better illustration, but for the sake of the plants, and, perhaps, of the visitors.

In foreign cities I have seen cathedrals complete in themselves, yet with numerous chapels attached, each, also, complete in itself. Some such plan, I imagine, might be adopted for the building of 1861. The United Kingdom, occupying a vast centre transept, with its colonies in Europe, Asia, Africa, America, and Australia attached, yet independent, so that each could illustrate its own climate, industries, resources, and peculiarities in its own way, subject of course to a general regulating control,—a fit representation of our glorious Empire, having the mother-land as a common centre.

I believe I may report that the Legislature of this colony will this year vote a sum of money for a Local Exhibition to be held in this city, prior to that of 1861, for the double purpose of local competition and for subsequent transmission of the collection to London. We shall endeavour, having more time at command, to make a larger collection than that sent to Paris in 1855, which gained the gold médaille d'honneur; the catalogue of which I had the pleasure of handing you in London in 1856.

I hope to be in England in the course of 1860. Having taken part in forwarding collections to Dublin and New York in 1853, and to Paris in 1855, on which latter occasion I acted as Colonial Commissioner during the whole period that the French Exhibition lasted, I think I may venture to say I have had considerable experience; and if my personal services would be of use for the coming Exhibition of 1861, I should have much pleasure in placing them at the disposal of the authorities.

I am, &c.,

W. H. HOLMES,

President of the Royal Agricultural and Commercial Society, British Guiana; Secretary to the Correspondence Committee.

City of Georgetown, Demerara, Feb. 24, 1859.

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th of April next.

Persons intending to be Exhibitors should communicate with the Secretary of the Society of Arts as soon as possible, stating:—

1st. The Title of the Invention.

2nd. Whether the Article will be a Model, Drawing, or Specimen.

The Articles must be forwarded to the Society's house, carriage paid. The days fixed for receiving them are Thursday the 7th, Friday the 8th, and Saturday the 9th April. No articles will be received after the last of these days.

Articles which have been included in previous Exhibitions of the Society of Arts cannot be re-admitted.

Articles should be accompanied by a short but clear description of the Invention, with a wood block (when possible) for illustration, and a reference to any publication in which the Invention is described.

All Drawings exhibited must be framed.

No charge is made for space, and the admission to the Exhibition is free.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

EXAMINATION PRIZE FUND FOR 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
— Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Messrs. Chance's Reading Rooms and Library, Birmingham.

Mr. R. L. Chance, jun.
Mr. Henry Chance.
Mr. C. Mapelin.
Mr. F. Talbot, *Secretary.*

For Bury Athenæum.

Mr. John Hocking.
Rev. Canon Hornby.
Rev. C. Hildyard, B.A.
Rev. W. R. Thorburn, M.A.
Rev. J. Westerman, M.A.
Mr. Josh. Pomfret, Athenæum, Bury, Lancashire, *Secretary.*

For the Glasgow Institution.

Rev. Wm. Fleming, D.D., Professor of Moral Philosophy, Glasgow College.
Rev. George Jeffrey, London-road.
Rev. Duncan M'Gregor, A.M., Free Church, Hope-street.
Mr. Thomas Morrison, Rector, Free Church Training College.
Rev. Archibald Nisbet, St. Stephen's.
Mr. Alexander Sim, F.E.I.S., St. Enoch's Parish Schools.
Mr. John Craig, F.E.I.S., 63, Cathedral-street, *Secretary.*

For Ipswich.

Mr. J. E. Champness, Schoolmaster.
Dr. Christian, Professor of Languages.
Rev. J. T. Cooper.
Dr. Drummond.
Mr. Robert Everett, Rushmere, Ipswich.
Mr. John Evans, Schoolmaster.
Mr. Henry Footman.
Mr. C. F. Gower.
Mr. T. S. Gowing.
Mr. J. P. Howe, Schoolmaster.
Mr. Alfred Lambert.
Mr. John Peachey, Schoolmaster.
Mr. John Ridley, jun.
Mr. J. R. Ross.
Mr. Charles Sulley.
Mr. Charles Silburn.
Mr. J. E. Thampness, Schoolmaster.
Mr. Sterling Westhorp.
Mr. John Wiggin.
Mr. Richard Gowing, Mechanics' Institution, Ipswich, *Secretary.*

For Wirksworth.

Rev. F. H. Brett, Rector of Carsington.
Dr. William Webb.
Mr. W. L. Hall, Mechanics' Institution, Wirksworth, *Secretary.*

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

SIXTEENTH ORDINARY MEETING.

Wednesday, March 23, 1859.

The Sixteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 23rd inst., J. B. Smith, Esq., M.P., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Crosley, Alexander.
Götzenberg, Herr.
Kirby, Capt. Wm. Frederick, R.E.
Lange, Christian.
Mocatta, Fredric D.
Nash, William Henry, B.A.
Thompson, Henry Attwood.
Webb, Edward.

The Paper read was—

ON THE GROWTH OF COTTON IN INDIA: ITS PRESENT STATE AND FUTURE PROSPECTS, WITH SPECIAL REFERENCE TO SUPPLIES TO BRITAIN.

By J. Forbes Watson, A.M., M.D., F.C.S., Reporter on the Products of India.

Considering the extent of the subject with which I have to deal this evening, it would be a waste of time to spend much in a long preamble. One remark, however, I must make with reference to the position I hold and the views I take. As Reporter on the products of India, it is assigned, as one of my more immediate duties, to bring before the public any matter of interest in a commercial point of view; and convinced as I am that there is no more practical method of accomplishing this than by bringing such subjects before a Society which has done so much for the true advancement of this country in arts, in manufactures, and in science, I shall, with the permission of the Council, and as occasion offers, avail myself of the present privilege of bringing to public notice, and submitting to discussion, the results of whatever observations I may have to make. At the same time, I have distinctly to state that no official importance attaches in any way to my views; for these I alone am responsible.

I have chosen the subject of the present paper by reason of the interest which attaches to any question affecting the prospective supply of that great staple on which, in no mean measure, depends our prosperity as a nation.

Into what may be called the polemics of the question, important as they are, I have no wish to enter; nor is it necessary: they have received full attention, both here and elsewhere.

The information which I have to impart is derived both from personal knowledge and from reference to works which any one may command. I have also had the benefit of comparing various written documents lately received from time to time at the India-house. From the Statistical Department there—the source of a good deal of unacknowledged information—I have received every assistance. To Mr. C. Prinsep I am, however, under special obligations, as well as to Mr. Mann; and to Dr. Riddell and to Mr. A. C. Brice, my thanks are equally due for having placed at my disposal, not only the results of their own observations, but also private documents of considerable interest. Of Dr. Royle's great work I have of course availed myself; and those who, like myself, have occasion to study and consider, in the light of new facts, the principles which he has laid down, will still more appreciate the great qualities which have rendered his loss a national one. Dr. Royle has been removed from us; but it will be satisfactory to the public to know that there is no reason to suppose that the Industrial Museum at the India House, with which his name ought ever to be connected, will be dispersed, nor that the other portions of the great national collection there, which, with the former, illustrate India in all its departments, will not receive an appropriate home in the new India Office.

In endeavouring to illustrate the capabilities of India for the growth of cotton, two lines of inquiry present themselves. We have in the first place to show that the climate and soil are suitable, and afford the fundamental elements necessary to the full development of the plant; and, in addition, to point out wherein either one or other of these is defective for that purpose. In the second place, we have to reply to the practical question—to what extent is cotton now cultivated in India. From the consideration of both classes of facts, we receive a practical reply.

As regards climate, no country in the world of equal extent is so favoured as Hindostan. This arises, to a great extent, from the physical inequalities of its surface, without which India would have been a vast desert. The Himalayas, rising from 20,000 to 29,000 feet, act as the great modifiers of temperature, and provide proper water supply to the rivers in the north, as well as to the atmosphere; while, in the south, the Malabar range of mountains, and the Eastern Ghauts, rise abruptly, and produce, in their turn, similar changes. In India we have the seasons divided into the cold, the hot, and the rainy. The great alluvial tract, to which more distinct reference will soon be made, connected with the Himalayan system of rivers, is subject to greater climatic changes than any other portion of India. There the mean temperature for the year ranges from 70° to upwards of 100°, and the amount of moisture in the air, from the point of saturation to all but absolute dryness. The influence of all this becomes observable when we consider the but partial success which has hitherto attended the culture of cotton in the north of India. In the peninsula of India the climate is different, as it is influenced by two monsoons: the south-west monsoon, which turns loose its torrents on the Malabar and western coast; and the north-east monsoon, which chiefly affects the eastern coast; and in some parts, as in Coimbatore and in Dharwar, the advantages of both monsoons are enjoyed.

The rivers not only locally influence the temperature and hygrometric condition of the atmosphere, but furnish the necessary supplies of moisture to the plant, as well as several of those constituents, both organic and inorganic, in which the soil may be defective. That the water of the Indus contains organic matter—a principle in which the soil of Sind is naturally all but totally wanting—is amply proved, even without chemical tests, by the smell of decomposition emitted when the inundation water has been kept for any length of time; and I find, in a sample of water taken in December, 1857, from the Tambrapoorney, in Tinnevelly, no less than 11·6 grains of organic matter per gallon in solution.

And now as to the soil. Although subject to considerable modifications, the soils of India may be divided into three great classes. In the North, we find great alluvial tracts, the results of countless ages of deposits from the majestic rivers, the Ganges, the Indus, and the Brahmapootra, which, together with their contributaries, fall respectively into the Bay of Bengal and the Indian Ocean. By this alluvial, India may be said to be bounded in the north; but passing southward and eastward from the delta of the Indus, we find the rivers of Guzerat and the intractable Nerbudda, have each afforded its quota to the same class of deposits. On the opposite side of the country, the mouths of the Godavery, the Kishna, the Cauvery, and sister rivers, supply soils identical in physical character; and stretching still further to the eastward to Burmah, extended evidence presents itself of that ceaseless attrition which at last subjugates the hardest rocks.

It is not possible for me to say exactly, or indeed with any amount of precision, how much of the 1,200,000 square miles which comprise Hindostan, consist of the deposits here referred to, but I believe at least one-third does so. Even this kind of soil varies of necessity in physical character, depending much for the greater or less amount of sand or grit which it contains, upon its proximity in past ages to the parent stream, the nature of adjacent soils, and other local causes: but generally speaking, the great alluvial tract of the Ganges and of the Indus is so similar in composition, that the one may be taken as the type of the other. Further on I subjoin analyses of two of these soils, which, along with several others, have lately been examined for me by Dr. Albert J. Bernays. Both are from Sind. The one marked *a* I took with me from Jacobabad, in Upper Sind, in the spring of 1852. It has never been manured or irrigated, and may be considered a fair type of the soil from the plain of the Indus. The second is marked *b*: it is from near Hydrabad.

a is of a light fawn colour, and almost impalpable. 2200 grains were examined, and found to consist of:—

a Impalpable particles	1908·5
b Sand of the finest description	226·5
c Coarse sand	5·0
	2200·0

The composition of the impalpable portion of this may well be compared with another, *b*, an altogether impalpable soil. In 100 parts both soils may be said to consist of:—

	a		*b*
Water	4·130	...	2·500
Organic matter	0·040	merest trace	
Cloride of sodium	0·003	...	0·006
Sulphate of lime	0·005	...	0·064
Phosphate of lime	0·084	...	0 008
Carbonate of lime	10·228	...	21·810
Carbonate of magnesia	0·034	...	0·113
Lime (probably as silicate)	0·120	...	0·135
Protoxide of iron	7·200	...	2·240
Alumina	16·400	...	15·080
Potash	0·110	...	0·103
Silica soluble	trace	...	0·131
Silica as sand, and combined with aluminium, &c.	61·550	...	57·249
	99·904	...	99·439
Loss	0·096	...	0·561
	100·000		100·000

Whatever is defective in these, considered solely in a chemical point of view, is capable of being supplied by the waters of the Indus. Irrigation is essential, not merely as bringing water, but also organic matter, and certain, though small quantities of salts, such as gypsum and common salt.

The next soil to which I would direct attention, is the well-known "black cotton soil" of the Deccan and other parts of India. In extent it occupies a position next to the alluvial. It stretches from Bundelcund in the north, nearly to the south of the Peninsula. A very considerable portion of the Deccan consists of this; it is also to be found in Guzerat and many other parts of the country. In depth it varies much. As to origin, it seems to have arisen from the decomposition of basalt and trap, which constitute, to a great extent, the mountain ranges on which the great plains of the Deccan are elevated, and the analysis confirms this supposition. The lime in which the parent rock is probably defective, it derives from other sources, so that nothing is wanting to develop perfect growth.* When dry it is dark coloured, and glistens from the presence of nearly pure grains of silica. It exhibits distinct traces of fibre, as also specks of limestone and minute shells. For water it possesses extraordinary attraction: it forms with it a most tenacious mud, and readily bakes into a brick.

1,500 grains were carefully washed with water, and afforded:—

	Grains.
a. Fine, almost impalpable powder	1075·
b. Small calcareous nodules or *kunkur*, removed from *c* by washing with dilute hydrochloric acid	75·
c. Fine sand, small silicious pebbles, and felspar	350·
	1500·

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* These points are more fully discussed in a work now in the press, the appearance of which has been delayed from the pressure of more immediate duties.

The fine powder, *a*, consisted of, when reduced to 100 parts:—

Water	11·400
Organic matter	2·500
Chloride of sodium	0·068
Sulphate of lime	0·074
Phosphate of lime	0·016
Carbonate of lime	9·250
Carbonate of magnesia	trace
Peroxide of iron	5·680
Alumina	14·320
Potash	0·014
Soluble silica	0·008
Silex combined, but chiefly free as fine sand	56·830
	100·160

The calcareous nodules consist, as the name denotes, chiefly of carbonate of lime, but contain also oxides of iron and aluminium. The coarser particles, *c*, contain as much as 0·187 per cent. of potash; this is undoubtedly derivable from felspar.

On the very face this soil bears the marks of undoubted fertility; in depth, too, it more than equals the far-famed prairie land of America. In a report lately received from Captain Meadows Taylor, I find it stated that in the centre of the valley of North Berar, the shafts of wells pass through from 90 to 120 feet of black earth and greyish clays; and throughout the greater portion of the plateau of the Deccan, this soil may be said to vary from 3 to 15 feet in depth. In many places it hardly contains even a pebble of any kind.

In referring to an analysis of a similar soil by the late Mr. Piddington, I find that the iron is stated to exist in the form of protoxide. I can only state that neither Dr. Bernays nor myself have found the iron in any other form than the peroxide.

The next and last soil of which I would here make mention, is one found in all parts of the country, but perhaps chiefly in Southern India, where it apparently mainly arises from the decomposition of granite rocks. Its lime and some valuable constituents are, however, obtained from different sources. In other parts of India this soil would seem to take for its origin rocks of a volcanic description, such as the red jaspery brick-like *Laterite*, which is found extensively in many parts of the country. The soil of this class, of which the analysis is subjoined, is from Bombay.

The quantity examined was 4,500 grains. It consisted of:—

	Grains.
a. Impalpable powder	936·0
b. Very fine soil	3324·0
c. Coarse pebbles, like jasper, with pieces like burnt tile, strongly retentive of moisture	240·0
	4500·0

The impalpable portion consisted of:—

Water	18·000
Organic matter	0·450
Chloride of sodium	0·083
Sulphate of lime	0·007
Phosphate of lime	0·027
Carbonate of lime	0·450
Carbonate of magnesia	0·013
Peroxide of iron	15·200
Alumina	16·500
Potash	0·085
Silica combined and free as sand.	48·000
	98·815
Loss	1·185
	100·000

The very fine soil *b* contains 0·012 per cent of phosphate of lime.

It is obvious that this soil, in spite of its density (which is, of course, much modified by the presence of sand and pebbles), likewise contains every element of vigorous growth.

Such are a few of the facts which have fundamental reference to the capabilities of India for the extended growth of cotton, that is, supposing there is nothing in the habitat of the plant itself which insists on climatic conditions only to be found within small limits. And this brings me to the next division of my subject,—to that which refers to the evidence afforded by the plant itself. Here I would remark there is reason to believe that from time immemorial the cotton plant has been grown in all parts of India, and has always afforded suitable covering to the people of the country. Not only does it serve for clothing, but it answers all the several purposes for which flax, wool, hemp, and hair are employed in this country. It may be indeed impossible to state the exact quantity per annum thus consumed; it has been variously estimated at from 5 to 20 lbs. per head for the whole population. If we assume 12lbs., as likely to be near the mark, we shall find that the present population of India, calculated at 180 millions, requires annually two thousand one hundred and sixty millions of lbs.: and, if we further adopt Dr. Royle's average of 100lbs. as the yield of native cotton per acre, we shall find that there cannot be less than twenty-one million six hundred thousand acres under cotton cultivation, exclusive of that which supplies the present exports of raw cotton. These on an average of the last three years amounted to 272,395,875lbs.;* and this again divided by one hundred, will add 2,723,958 acres to the former quantity. The total quantity of cotton grown in India, according to the above calculation, will consequently amount to upwards of two thousand four hundred millions of lbs. (2,432,395,875lbs.) per annum, and demand for its culture certainly not less than twenty-four millions of acres.† The production of this enormous quantity of raw material is, of course, spread over the length and breadth of the land; indeed, a considerable portion of it is the result of garden cultivation to supply the local wants of the people. The map‡ which accompanies this paper indicates by darker shades those districts where the culture of cotton has been, so to speak, intensified. It purposes to give a view of those tracts of country which are at present most productive, and which yield the largest quantity of cotton, as well for home consumption and manufactures as for export.

The causes which have determined the extra productions in certain parts of the country are of two kinds. The first refers to the peculiar capability of the soil and climate of the parts indicated; the next to demand, which has acted as the exciting cause; and a more interesting investigation could scarcely be undertaken than one calculated to exhibit, over long periods, those changes which have arisen partly from the decay of power to meet protracted demands, partly from the establishment of fresh and more effective sources of supply. The home market of India has always been subject to the usual influences which arise from the existence of competition. In days gone by the sea-borne cotton of Surat competed in the Bengal market with the river-borne produce of Bundelcund and with supplies from Berar, which had to be conveyed 400 miles from the interior. And here I would remark that no better practical test of the relative capabilities of the cotton districts of India can be obtained than that which has reference to the power of yielding a continuous supply in the face of great export difficulties; and further on we shall have occasion to refer more particularly to this last point, when condering the prospective supply to this country. Let us glance at this part of the subject. It does not appear improbable that in remote times Bengal grew all the cotton she required for home consumption as well as for manufacture. Shortly, however, after our acquiring possession of the country we find that Bengal did not produce enough for her own use, nor one-eighth of that required for her manufactures, which had been greatly stimulated by the new demand for cotton goods for general use in Europe. Orissa, at the period of which we speak, became likewise another great seat of the manufacture of cotton cloth for Europe; and, in addition, Injeram and Madapollam, in the northern Circars, wrought up large quantities of staple for the same purpose. Let us now apply the test before proposed. Here we have three great sources of demand. Anteriorly to 1783 the two first certainly, probably also the last, were supplied from Surat. Then war arose in Guzerat, which interrupted and diverted the supplies; and, apparently coincident with this, we find the first importations into the lower provinces of river-borne cotton from Bundelcund, and probably also the Gangetic Doab. The necessity once created, other sources of supply rapidly came into play; as a result of which we find (as stated above) that after a very few years cotton was conveyed from Nagpore in Berar over a space of 400 miles on the backs of bullocks to Mirzapore, on the Ganges, and subsequently nearly 500 miles by river, competing successfully and permanently with the sea-borne cotton of Surat, as well as with that by river from the north-west.

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* See bottom of column T, in Table II. This includes cotton to Britain, China, and all other parts.

† This is exclusive of the ground required to grow the six millions of lbs. weight of manufactured cotton exported yearly from India. See Table II.

‡ By Mr. Walker. Presented to the Society by the Secretary of State and the Council for India.

In 1789 the Nagpore cotton, from its superior quality, held the first place in point of value, and constituted two-fifths of the total quantity supplied to Bengal. At that period it is calculated that the price of cotton at Berar could not have much exceeded one penny per pound: and then, and for some considerable time afterwards, we find the third head-quarters of demand to which we have referred, viz., that of the Northern Circars, chiefly supplied from the same source. And it must be borne constantly in mind that to accomplish this end, the Nagpore cotton had to bear the expenses of a journey southwards of upwards of 400 miles, one-fourth part of which had to be undertaken through dangerous jungles and a most disordered country.

We have already stated that cotton is the material for all clothing worn in India. It is not there as with us, where the linen and woollen manufacture share with cotton. For at the period of which we are speaking, the cotton manufacture was of very limited use in Europe, and none could then have predicted the present throb of anxiety to obtain the raw material wherewith to manufacture what sixty years since we obtained entirely from the East. How vast the change! The export trade of India in manufactured cottons has almost passed away, and she is daily becoming more and more the receiver of what was originally all her own. The causes which have led to this result—the inventions of Hargreaves, Arkwright, Crompton, and of Watts—are well-known. I shall, therefore, return to the production of cotton in India.

Sixty years since, as we have seen, Guzerat, Berar, Bundelcund, and the Gangetic Doab monopolized almost the entire export trade of raw cotton. Thus the indigenous cotton of India has supplied for ages the wants of the inhabitants, and in these latter days furnished fabrics to Europe of unequalled delicacy and beauty. But in the process of manufacture by machinery it is found, that for some purposes Indian cotton, which is naturally short in the staple, is not so suitable as the longer variety furnished by the Southern States of America, and usually called New Orleans cotton. Although no doubt exists about this fact, it is to be remarked that the increased price of the last few years, and the prospect of insufficient supplies from the States to meet the rapidly increasing demand for cotton goods, have of late produced a considerable modification in the views of our manufacturers as to the suitability of Indian cotton for extended employment in their mills; and I believe I am correct in stating that it is generally admitted, that Indian cotton, with all its imperfections, is capable of being employed in the production of 75 per cent. of our manufactures.

It is most desirable, however, that the New Orleans variety of the cotton plant should, as far as possible, be cultivated in India: this subject, for fifty years has received the earnest attention of the Government, and in furtherance of it immense sums have been expended. Were I to present even the most meagre details of the experiments which have been made both by Government and private individuals, whose enterprise is above all praise, more than the whole of my time this evening would be occupied. I prefer, therefore, to deal with results, and with any other facts which may pertain to this division of my subject.

In the map, I have indicated by means of crosses (×) the situations where these experiments have been conducted; and it will be at once observed that almost every district has furnished opportunities for these.

The results deducible from experiments conducted on the great alluvial tract previously described, and which, with certain modifications, embrace Bengal, the North West provinces, the Punjab, and Sind, taken in connection with the past history of the question, and in view of those considerations which arise from the analyses, may be briefly stated. In the lower part of Bengal, in the rich soil of the delta around Dacca, the experiments with American cotton failed, partly from apparent causes, partly from climatic disasters of an exceptional character. Here, as in Sind, the greatest preventive of extended cultivation arises from the ravages of insects, which attack and ultimately destroy the plant. I must, however, state my belief that, with irrigation, *properly* employed, hopes may be entertained that the long-stapled South Sea Island species, the *Gossypium Barbadense*, as well as the ordinary New Orleans or Upland cotton—the *Gossypium Peruvianum*—might be turned to account. But just as we have found it in days past, Bengal is not likely to afford any extensive supplies of native cotton, which has all along been held in bad repute here. Passing northward to the moist valleys of the Sikkin range, we entertain from Dr. Campbell's late experiments some hopes that eventually the long-stapled cotton may succeed there. The same remark applies to other valleys connected with the mountain ranges of the north, which possess moister climates and a more equable temperature than that afforded by the plains. Turning to the north-west provinces, and likewise to Oude, and embracing the Punjaub and Sind, considerations connected with the soil, the climate, and the past history of the country, lead to the conclusion that, by irrigation alone can we expect to obtain from these places any extensive supplies of either native or exotic cotton. Of late years we have had abundant evidence, that, with judicious irrigation, the yield of clean cotton obtained per acre is likely to become very considerable. Sir John Lawrence states that in the Delhi division from 224 to 384lbs of clean cotton has been grown on some lands by irrigation; and in Rohilcund, without this adjunct, large crops are occasionally obtained. The average yield per acre in the north-west provinces is estimated by Dr. Royle at 162lbs.; and it must be noted, that, although many plantations in the United States yield from 200 to 400lbs. per acre, yet the average yield of all the cotton states is not more than 530lbs. of seed cotton, or from 132 to 176lbs. of clean.*

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* See Ellison's excellent Handbook of the Cotton Trade, p. 18. The proportion of wool to seed therein stated seems rather too high; it varies from one-third to one-fourth.

Accounts from the Punjab show that excellent cotton may be produced there; it presents a fair field for efforts in this direction, as well as for the cultivation of the other great staple, flax, about which a wholesome anxiety is now being manifested.

From Sind, the scene of Mr. Frere's enterprising efforts, we have late accounts, showing promise for the future. In Upper Sind the yield per acre has been very small, amounting to but 39lbs. of clean cotton; but in Hyderabad, Kurrachee, and in the delta of the Indus 244 lbs., 159 lbs., and 124 lbs. have respectively been obtained. These, however, are maximum quantities; the average for Middle and Lower Sind being 104 lbs. Hitherto the indigenous cotton has succeeded much better in Sind than the exotic or American species, failure being attributable to excess of moisture from inundations, and from the boll-worm, which has proved most destructive. In no part of India is the regulation of moisture under greater control, and there can be no doubt that, with care in its application, more attention to the selection of seed, and other points connected with the cultivation of the plant, it may eventually furnish some considerable supplies to this country.

Passing southward and to the east we come to Guzerat, embracing under that name, Surat, Broach Kaira, Ahmedabad, and Kattywar, which at present yield a larger quantity of cotton for export than all the rest of India together. This extensive tract of country is then the same which, even towards the close of last century, we found to supply a portion of the wants of Bengal. No district has received more attention, and in it numerous experiments have been made with a view to establishing the growth of exotic cotton. This attempt has hitherto so far failed; but the indigenous, compared with other Indian cottons, holds a good place in the market in point of quality; and were it not for the carelessness of picking, and the systematic adulteration which it oftentimes receives, it would command a better price.

Although, then, the general character of Indian cotton is bad, on account of its condition, it is an extremely interesting fact to know that Mr. Landon, who has established himself at Broach, in the two capacities of spinner and manufacturer, obtains cotton well suited for all his purposes, and which enables him to turn out No. 40 yarn from what here only produces No. 16. This amply proves that parties interested, and on the spot, can procure better cotton than is sent into the general market, Mr. Landon's secret of success being, that he refuses to purchase a dirty article. The culture in the districts we are now considering is admitted to be about as perfect as any that exists; in some respects, indeed, it is superior to what is practised in most parts of the Southern States of America where the same strict attention to fallowing and rotation is not observed. The introduction of irrigation would doubtless improve it, by preventing the effects produced by the drought which follows so immediately upon the rains, and which dries and shrivels the plant at about the most important part of its growth. No districts present greater facilities for export, and as a consequence we find that whenever the demand for Indian cotton is excited by an enhanced price in Liverpool, the export steadily increases. This is well shown in the accompanying table, the upper columns of which indicate the quantities sent from the various specified districts between the years 1852 and 1857, both inclusive. From this it will be seen that in the latter year the exports amounted to 196,809,872 lbs., whereas, in 1852, to only half the quantity. That this increase was mainly due to the rise of price at Liverpool, can be abundantly proved, and will be again referred to in our general summary; it also exhibits the great export elasticity, so to speak, of these districts, and contrasts favourably with others yet to be mentioned.

Amongst the inland districts alluded to in the table are Candeish, Ahmednuggur, Poona, Sattara, Sholapore, and Berar; of these the first and last are most important. Their capabilities are very great, especially those of Berar, which seems destined to occupy a high position in supplying our wants. It is true that at present the quantity grown at Candeish is trifling, but the experiments of Mr. A. Elphinstone, of Mr. Price, and of others, show that even American cotton can be cultivated. And there is no question but that, with proper means of irrigation, and increased facilities for exporting the products of the soil to the coast, Candeish will soon occupy a very high position. At present the cotton has to be conveyed in carts over bad roads, a distance of about 180 miles, to Colset Bundar, the nearest point to Bombay, which receives for shipment to England all that is grown on the western side of the continent.

TABLE I.*

Places of Growth.	Years.				
	1852–53.	1853–54.	1854–55.	1855–56.	1856–57.
Surat, Cutch, Broach, and Ahmedabad .	99,923,544	106,888,992	58,119,096	143,656,534	196,809,872
Candeish, Ahmednuggur, Poona, Sattara, Sholapore, and Berar	75,488,224	63,066,136	40,537,504	59,440,528	65,243,304
Belgaum, Dharwar, Raichoor, Bellary (west side), and Kurnool	39,200,000	17,640,000	13,284,096	13,565,160	29,008,000

With regard to Ahmednuggur, Poona, Sattara and Sholapore, little need now be said, as the quantity grown is so small; but this will scarcely continue to be the case if better facilities of carriage are offered. I must, however mention that all attempts to grow the American cotton here have hitherto failed.

Turning now to the valley of Berar, which, in times past, competed so successfully against great odds with apparently more favoured districts. For a number of years the trade current of Berar flowed entirely northwards to Mirzapore on the Ganges, but in 1824-25 an attempt was made, headed by our noble-hearted Parsee Baronet, Sir Jamsetjee Jeejeebhoy, to establish a traffic in cotton between Berar and Bombay. The decline of the Bengal manufactures aided the effort, and shortly afterwards we find the westward current so fully established that, in the year 1846, it was calculated that not fewer than 180,000 bullocks were employed in the conveyance of cotton between those two places. Soon, however, a maximum export quantity was reached, due to the limits placed upon this sort of conveyance; and the result has been that, unlike the sea-washed borders of Guzerat, whatever has been the prevailing price in the market, the quantity sent from this prolific valley of Berar has remained almost stationary. Indeed, Table I. exhibits the fact that, in spite of the present prices of cotton, both Berar, Candeish, and other inland territories similarly placed, owing to imperfect communication and insufficient means of carriage, have considerably declined in their exports to Bombay. The usual law of supply following demand is powerless in the face of such difficulties. But of the eventual power of Berar and the adjacent country to supply more than one-third of the thousand million of pounds of raw material now yearly required for our factories, I believe there can be no doubt. Looking to the capabilities of this huge tract of country, which may be considered, *par excellence*, the great cotton field of India, having regard to the great skill of the cultivators, and the cheap rate at which it can be grown, we are warranted in looking to it with much hope, and in the full expectation that it will yet materially assist in making Great Britain less dependent upon slave-grown cotton. The whole history of this portion of the country bears out the view entertained of it.

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* Taken from an excellent paper, by Mr. A. C. Brice, and received from the Railway Department at the India Office.

The indigenous cotton of Berar is, in excellence of quality, second to none that is grown in India, and we conclude from the experiments of Dr. Riddell, and from those which have been made by others following in the same track, that the New Orleans plant will perhaps succeed, and may yet be cultivated. Our wants, however, are pressing, and the practical fact remains, that we are free from all doubts as to success in the extended cultivation of an article which will suit the majority of our purposes. All that is wanting is improved means of exit to ensure a speedy development of the supply.

From Berar, although there are many points connected with the soil, climate, and mode of cultivation, over which I would fain linger, I pass to the consideration of another great and important tract of country, likewise forming a portion of what may be included among the upheaved plains of the Deccan. I allude to Belgaum, Dharwar, Raichoor, the west side of Bellary, and Kurnool, to which some of the remarks made as to Berar, Candeish, &c., are likewise applicable. What I have said with reference to intercommunication and export is borne out again by referring to Table I. Here, although the inducements to export largely came into fair force two years before the last one mentioned in the table, and although these districts had the advantage of energetic endeavours on the part of a gentleman whose name I have already had occasion to mention this evening, and who will, I dare say, favour us with some of the results of his experience in this matter, still the general fact remains. With very considerable demand, and large supplies in the interior, the difficulties of transit are such that the increase of exports from these parts, although marked, are comparatively speaking trifling. The Dharwar district, well known to some here as the scene of Mr. Shaw's enterprising and successful endeavours to introduce the culture of New Orleans cotton, boasts a climate within the influence of the two monsoons. Although the rainfall in inches is not much greater than in many other inland parts of the country, the climate is moister, in consequence of the passage of the monsoon vapours which spread over the country at the usual periods, and thus affect the hygrometric condition of the air. There it is that the best success has attended the introduction of the American cotton. The soil at a trying season of the year (in October) receives fresh supplies of moisture, and consequently the plant is not subject in Dharwar to those droughts for which, in other districts, irrigation can alone prove a remedy. Here, as the result of Mr. Shaw's successful efforts, as well as Mr. Mercer's judicious arrangements, the people themselves have taken up the culture of the American variety of the plant. Unfortunately, however, a serious depreciation of the Dharwar cotton has arisen from sowing American in the same field with indigenous, and unless this be discouraged, great mischief must result.

The extent of land under cotton culture in the Mahratta country extends over a million acres, and it is asserted, on the best authority, that three times that amount is well adapted for the purpose. The present amount grown in this large territory, as well for home supply as for export, is estimated at 51 millions of pounds; but supposing the statement of acreage under culture to be correct, this is probably considerably under the mark, as we have reason to believe that the yield per acre is not less than 80lbs., and it sometimes attains to 120lbs. At present the produce has to be conveyed by land carriage a distance of from 150 to 200 miles to the fair weather port of Tuddry. The difficulties of transit are such, that the expense of carriage per mile amounts to from 4d. to 7d. per ton; or taking 150 miles as the average distance, and 5½d. as the average cost, we find the present expense of simple conveyance to the coast amounting to £3 10s. per ton, or to more than the freight of over 13,000 miles of sea to England. Great exertions have been made to improve the communication to the coast, but hitherto without success; the failure arising from the nature of the soil, and the absence of suitable materials for macadamising the roads. Nor is this a solitary case, as probably more than one-half of the best lands of India are subject to the same drawback. The difficulties in many parts, in the way of forming hard and durable roads, are all but insurmountable. There are vast tracts of fertile country in India, which hardly afford a stone of any kind, and which by rain are rapidly converted into a tenacious mud, into which carts sink axle-deep. The famous black soil we have found to be pre-eminently of this description, and frequently also the red. The difficulties, therefore, opposed in many places to the opening up of the country by means of common roads, are of no ordinary kind. But this matter of conveyance is not the only difficulty which India cotton experiences before it has a chance of entering the Liverpool market. In addition to the actual expense of carriage to the coast—returning to the case of Dharwar—we find the cotton subject to damage from water, to charges for sea transit to Bombay, and then to charges there, all of which amount to about £1 15s. per ton. In the cases we are considering, the cotton is very often delayed at the place of growth for months after it is cropped, owing to the monsoon closing both the coast and roads; and it is admitted that the deterioration in value of the cotton so delayed is equal to ¼d. per lb.

The expenses may be thus summed up: taking the cost of raising the cotton at 1½d. per lb., adding another 1½d. per lb. before it gets to Bombay, and setting down the transit, &c., to England at another 1d., the cotton cannot be sold under 4d. per pound.

Again, taking the produce of the million acres under consideration, we find that the depreciation of ¼d. per lb. above alluded to, would amount of itself to £53,000, supposing of course that the whole quantity should, under present circumstances, be exported.

One more remark as regards this portion of the country. I may mention that in the Southern Mahratta country as elsewhere, the American cotton is found to grow best upon the red and light soils, the capacity for moisture of which is usually considerably less than that of the black; the latter, however, yields excellent crops of indigenous cotton.

Passing southwards over the great plateau which forms the Mysore territory, and which apparently by nature is not calculated to assist much in the supply of cotton, we come to Coimbatore, which, viewed as a probable field of prospective supply of the more valuable exotic species, fully ranks in importance with Dharwar and Belgaum. It was here that Dr. Wight's experiments, which have excited such interest in this country, were conducted. Coimbatore slopes down from the base of the Neilgherries, opposite a remarkable depression or gorge in the western Ghauts of about 16 miles in breadth, and through which the influence of the south-west monsoon is permitted to bear on the country. Like Dharwar, it also receives supplies from the north-east monsoon. The results deducible from Dr. Wight's experiments may be briefly stated.

The quality of the American cotton grown in the Coimbatore experiments was superior to any previously obtained in India: that grown in the red soil was at the time considered in Manchester quite equal to the qualities of the New Orleans cotton grown in the United States, and it fetched from 1d. to 1½d. per lb. more than the native. The returns of seed cotton from the American kind were as a rule more than from the native, and the proportion of wool to seed is stated to be greater in the exotic kind to the extent of from 7 to 9 per cent. The general accounts on this point lead to the conclusion that "kupass" or seed-cotton, of the American species grown in India, as a rule, yields from 29 to 33 per cent. of clean cotton; whereas that procured from native only averages from 21 to 25 per cent.* The yield of seed from the exotic kind is consequently less than from the native; and as the whole of the seed from the cotton in India, except that retained for sowing, is required for feeding purposes, it offers an additional inducement for growing the native variety, more particularly in those districts where grain and grass crops are either normally difficult to raise or subject to damage from atmospheric and other vicissitudes. And although doubtless cattle will eat of seed from both kinds, still, from the greater difficulty of separating the wool from that of the American, the practical result is, that it is more woolly and less suited as an aliment. Be the reason, however, what it may, there is no doubt of the fact, that in all the districts into which the American plant has been introduced, the seed of the native variety has invariably been more esteemed, and fetched a higher price; and with these circumstances in view, this preference may fairly be held to be reasonable. Greater attention to the grain crops on the spot, or the opening up of communication with the districts which are better calculated than many of the cotton ones for the production of food materials, will, however, tend to remove this unwillingness on the part of the cultivator, even should not the enhanced price for the superior wool induce him to do so. Under present circumstances this is a matter of extreme difficulty, as it is the grasping policy of native agents, or middlemen as they are called, to let the poor ryot profit as little as possible from any of the changes which the influence of Government officials or others may have induced him to make. Improved means of communication, or, in other words, the circulation in the district of European agents with money in their hands, and who will be prepared to demonstrate to the cultivator what crops they really do prefer, and for what they will pay most, will remedy this state of matters. Thus alone will demand produce supply.

We must, however, hasten very briefly to refer to the other districts on the eastern coast, all of them important, and which at present have supplies for export over and above their own natural requirement. We allude to the east side of Bellary, Guntoor, Cuddapore, Salem, Madura, and lastly, at the extreme end of the peninsula, Tinnevelly, which is one great source of supply to China, and at present sends out fully more than all the others put together, although there is every reason to believe that these also will in course of time occupy an important place in supplying raw cotton and many other valuable products besides. The quantity of ground in the regions enumerated suitable for the growth of cotton amounts to many thousands of square miles, and I cannot do better than close my remarks on this the last division of India proper, with some statements of Dr. Wight on this point. Taking the four southern provinces of the peninsula—Coimbatore, Salem, Madura, and Tinnevelly, Dr. Wight calculates that these afford 4000 square miles (a mere fraction of India) which might and would annually be under cotton culture in the event of a rise in price of only ¼d. per lb. in the local market. Consequently, at the rate of only 100lbs. of picked cotton per acre, we should obtain from those districts alone 256,000,000lbs., or more than that at present received from the whole of India.

With the exception of Cuttack, Chittagong, and Burmah, we have now passed rapidly, and so far imperfectly, under review the whole of those parts of India in which cotton is cultivated. Chittagong has long shown some export capacity; and reports which I have before me from Burmah, lead me for the last time to apply the term "fair hopes for the future."

Taking into consideration the time yet at my disposal, I can only follow out one of the two branches into which my subject divides. I might enter upon a minute investigation of the various points connected with the cotton culture and manufacture; a description of the native modes of preparing the field for its reception, and the implements employed; the mode of sowing, together with the questions connected with the times so suited in the different parts of India; the amount of attention paid to subsequent weeding; and the periods occupied by the growth of the plant. I might describe the removal of the cotton from the field, and the various questions connected with adulterations, either wilful or accidental; the separation of the wool from the seed—the foot-roller and the churka—the importance of the introduction of cheap and effective gins; the preparation of the wool for the market; its removal to the delicate and sensitive hand of the native spinner, and the simple method adopted for ages in the preparation of their yarns and the manufacture of their cloth; the question of superior durability, compared with machine-made fabrics; and, lastly, the consideration of the principles which ought to be observed by our manufacturers here, in order to produce materials both more adapted for the climate in texture, more in accordance with what experience has taught the people to be most suitable for their wants, and in appearance such as will captivate the eye. I might enter upon these points, but I shall better consult the interest of my present audience by proceeding to discuss those which have a more distinct bearing on the question of the prospective supply of Indian cotton to Great Britain.

I have already endeavoured to give a sketch of the general capabilities of almost every part of India for the growth of cotton, and I have shown that, independently of the large quantities grown for local consumption, certain districts are wholly occupied with its cultivation for export. Thus we have seen, that the sea-indented lands of Guzerat, with its comparatively numerous outlets, have, ever since our acquisition of the country, and probably long before, been one of the chief sources of supply to other parts of India in their palmy days of manufacture, and we have found these, within the short space of five years (Table I.) doubling their exports to meet our wants. Again, passing into the interior of the country to Berar, we find a huge tract which from its superior cultivation and produce has, in the face of enormous transit difficulties in days past, been able to supply places distant from 400 to 1,000 miles; and even now, with prices much below those of former years, finding it sufficiently remunerative to admit of an exit stream of some importance, although limited by causes which are evident.

Turning to the south, another extensive and important cotton district presents itself in the Southern Mahratta country, which, in spite of difficulties not likely to be overcome by ordinary means, is nevertheless enabled to send into the Bombay market certain supplies of cotton; and the same applies to almost every other remaining district that exports it. And so we deduce the argument. Leaving out of sight any question connected with internal administration, with assessment, with land tenure, or with anything else, we must come to the conclusion that hitherto it has either paid India to send us cotton, or that she has exported at a loss; but, as we find our supplies from thence, instead of diminishing, increasing, in the past 18 years, from seventy-seven millions to nearly three times that amount, we must conclude that it does pay her to do so. The facts already brought forward, as well as those about to be deduced, lead to the irresistible conclusion that India is most in want of better communication. But, before touching further on this point, I would say a few words with regard to the important question of cost of production. And here I cannot do better than adopt Dr. Royle's statement on this point, one not arrived at by any partial glance, serving only to suit one side of a question, but from searching inquiry amongst the extensive sources of information at his disposal. His conclusions are drawn from a consideration of all the elements which enter into the calculation: such as rent paid for land; cost of implements and of seed; expenses of ploughing, weeding, gathering, and preparing the wool for the market; and his conclusion is, that not merely viewing the country as a whole, but likewise having particular regard to those districts which may be looked upon as peculiarly suitable to the extended growth of cotton, the Ryot is able to sell it at a price varying from 1d. to 1½d. per lb., 1¼d. being a common price. It is true that there are some districts in which the price mounts to 2d. per lb, for instance in the Rohilcund division; and this, too, notwithstanding the fact that the yield per acre is double that of the cotton exporting districts. The reason of this is worth attention. Though the Government demand for revenue amounts only to 3s. 10½d. per acre on the entire cultivation, the Zemindar underlets what he considers good cotton lands to the Ryots for not less than 8s. per acre.

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* Some observations by Dr. Riddell on this point lead to a different conclusion.

So far, then, with regard to the cost of production: turn now to an allied subject. There are many here to whom it will be no new information to be told that, although, as seen in Table II., columns A and B, (p. 286,) Britain is chiefly supplied with cotton from America and India, still, from the hitherto over-powering productiveness, combined with transit facilities of the former, the element of competition has not had full play. Up to the present the supply from India has been entirely influenced and over-awed by that from America. Omitting years like 1835, when New Orleans cotton was selling at 10¼d., and Surats (or East India) at 7½d., and coming down to these later days, when, as will be seen from columns E and F in Table II., that American cotton was selling at Liverpool nearly as low as 4d., and Surats at 3d., and we shall see reason to conclude that the development of the power of India to compete with America is in one respect a question of price. Of the superior quality of the American cotton there can be no doubt, and a glance shows that every pound of New Orleans cotton fetches upwards of 1d. more. There is, indeed, every reason to believe—nay, there is absolute certainty of the fact—that, eventually, Indian native cotton will be sent into the market both cleaner and of greater value; and also that cotton grown from American seed will, in time, be produced of a quality of the same average goodness. But I would deal with the question not merely as a thing of possibility but of fact. A further inspection of Table II. affords abundant evidence of the present sensitiveness of the Indian export trade, and the manner in which it has hitherto been controlled. It appears that, under present circumstances, it would be impossible, with any profit, to import Indian cotton into Liverpool under 3½d. per lb., but as we find that American invariably brings from 1¼d. to 1½d. more than East Indian, it becomes of interest to inquire how often, during the last eighteen years, the India merchant has been compelled to sell below a remunerative price? This has occurred five times since 1840. The two points connected with the subject of increased supply are brought into clear relief by these tables. During the year 1845 one of the largest crops which had, up to that period, been grown in America was produced, and, consequently, such a considerably larger quantity was introduced into the Liverpool market, that the price fell to a point which obliged the holder of Indian cotton to sell at 3d. per lb. The result was, that in the following year the export from India fell to nearly one-half of what it was in the preceding year. As an opposite illustration, let us take an increased supply owing to better prices. In 1855, the price of cotton rose from 3½d. to 3⅞d. per lb., and the exports in the following years increased by 35,000,000 lbs. In 1856, however, in consequence of the price of American cotton having risen from 5¾d. to 6d. per lb., Indian cotton fetched 4⅜d., *and the year after we received the maximum quantity yet imported from India*, viz., 250,000,000 lbs. This latter quantity, however, as matters at present stand, must not be considered as entirely the result of increased production, for, although the price had risen to 5⅜d., the quantity obtained from India the following year only reached 138,000,000 lbs.

Again, looking to the present state of the labour-market in America, and to the evidence we possess, that the maximum of effort has probably been exerted to meet enhanced prices, and that, as a result, the production of the raw material for the average of the last four years has risen to a higher level than had hitherto been attained, notwithstanding *the price is fairly sustained*, we conclude that demand is in excess of supply, and that, as far as India is concerned, she may in future cultivate cotton without any fear of loss. And this view receives confirmation from the fact that the cost of production in America is not less than 3d., and probably 3¼d. per pound; and we have it on the best authority that in 1845 and 1848, when the average price of upland cotton in Liverpool was 4⅜d. to 4¼d. respectively, the planters throughout the southern states declared that they were working their estates for the most part at a loss.

While, therefore, we recognise the importance of the efforts which are being made by the Cotton Supply Association to encourage the growth of cotton in all parts of the world, and hail with satisfaction the success which is attending Mr. Clegg's efforts in Africa; still, for many years, whatever may be the result in other quarters, we must look to India, and India alone, for a continuous supply of what we require. And although in view of the facts admirably worked out in Table III.,* (p. 287,) for which we are indebted to Mr. Bazley, showing the value of cotton goods per head consumed by all the inhabitants of the principal countries in the world—looking to the small amounts taken by many of these, the paltry sums per head by India and Africa, and the certainty that, with ordinary freedom of access, machine-made fabrics will, in point of price, ever beat those of the hand: considering, too, that in consequence of increased demand to supply the teeming millions in China and elsewhere, it may not happen that the price of raw cotton will ever fall so low as to send slavery below the paying point; still, if this is to be brought about by cheaper cotton, India is, I believe, capable of producing that effect.

But let us finally consider the question of the prospective development of the production of cotton in India. What warrant is there for using the hopeful language I have employed?

I hold it proved that India possesses a latent power to supply cotton to any amount; and I assert that a fair consideration of circumstances now existing, or capable of being brought into active play, leads to the conclusion that we shall not look to her in vain.

I have shown that there is every reason to believe that in future, as far as America and other cotton-producing countries of the world are concerned, there is no prospect of production being carried to such an extent as to reduce the value of Indian cotton below the paying point. We have already ascertained the influence of price, and we conclude that this inducement on the part of India to grow cotton will be a lasting one, as it can be grown at a rate varying from 1¼d. to 1½d. per lb. Our evidence leads to the deduction that further facilities of transit will so diminish the rate at which India cotton

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* Reprinted from Ellison's Handbook of the Cotton Trade.

TABLE II.

Table showing the Quantity of Raw Cotton Imported into the United Kingdom since 1840, the Price per lb. of American "Uplands" and East India "Surat" Cotton, in the Liverpool Market, the Quantity of Yarn and Manufactured Cottons Exported from Great Britain to India; of Raw and Manufactured Cotton Exported from India to Great Britain, China, and elsewhere; and lastly the Value of Cotton Manufactures Exported from Great Britain to India, and of Raw Cotton and Piece Goods Imported into Great Britain from India, for the same period.

Years.	RAW COTTON.						EXPORTS FROM GREAT BRITAIN TO INDIA.†			
	IMPORTED INTO UNITED KINGDOM FROM				PRICE.					
	U. States.	East Indies.*	Other parts.	Total.	Annual Aver.		Manufactured Cottons.		Yarn.	Total.
	lbs.	lbs.	lbs.	lbs.	Up-lands.	Surats	Yards.	lbs.	lbs.	lbs.
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
1840	487,856,504	77,011,839	27,619,667	592,488,010	6	4⅝	145,083,799	27,203,212	16,013,708	43,216,920
1841	358,240,964	97,388,153	32,363,238	487,992,355	6¼	4⅝	145,881,219	27,352,729	13,144,648	40,497,377
1842	414,030,779	92,972,609	24,746,698	531,750,086	5⅜	4	155,506,914	29,157,546	12,050,839	41,208,385
1843	574,738,520	65,709,729	32,744,867	673,193,116	4⅝	3⅝	216,862,174	40,474,158	16,802,958	57,277,116
1844	517,218,622	88,639,776	40,252,906	646,111,304	4⅞	3⅝	239,493,471	44,905,026	22,084,132	66,989,158
1845	626,650,412	58,437,426	36,892,115	721,979,953	4⅜	3	229,260,682	42,986,378	16,823,846	59,810,224
1846	401,949,393	34,540,143	31,366,738	467,856,274	4⅞	3⅜	231,694,439	43,442,707	24,193,923	67,636,630
1847	364,599,291	83,934,614	26,173,710	474,707,615	6⅜	4½	149,414,176	28,015,158	15,688,997	43,704,155
1848	600,247,488	84,101,961	28,670,712	713,020,161	4¼	3¼	185,375,540	34,757,914	17,991,526	52,749,440
1849	634,504,050	70,838,515	50,126,447	755,469,012	5⅛	3⅞	269,833,885	50,593,853	21,096,702	71,690,555
1850	493,153,112	118,872,742	51,551,007	663,576,861	7¼	5⅛	284,537,862	53,350,849	20,303,013	73,653,862
1851	596,638,962	122,626,976	38,113,811	757,379,749	5¾	4	323,930,636	60,736,994	24,400,116	85,137,110
1852	765,630,544	84,922,432	79,229,472	929,782,448	5⅜	3¾	312,473,351	58,588,753	23,049,210	81,637,963
1853	658,451,796	181,848,160	54,978,793	895,278,749	5⅝	3½	321,413,627	60,265,055	23,392,329	83,657,384
1854	722,151,346	119,836,009	45,345,794	887,333,149	5⅜	3½	478,750,717	89,765,759	25,094,439	114,860,198
1855	681,629,424	145,179,216	64,943,312	891,751,952	5¾	3⅞	424,631,817	79,618,466	27,447,590	107,066,056
1856	780,040,016	180,496.624	63,349,888	1,023,886,304	6	4⅜	423,304,389	79,369,573	23,085,680	102,455,253
1857	654,758,048	250,338,144	64,222,704	969,318.896	7¼	5⅜	419,266,233	78,612,419	17,846,904	96,459,323
1858	833,237,776	132,722,576	68,381,824	1,034,342,176	6¼	4¾	...	...	...	...

Years.	EXPORTED FROM INDIA TO										VALUE.	
	GREAT BRITAIN.		CHINA.		OTHER PARTS.		ALL PARTS.				COTTON, YARN, AND MANUFACTURES.	
	Piece Goods.	Raw Cotton.	Piece Goods.	Raw Cotton.	Piece Goods.	Raw Cotton.	Piece Goods.		Raw Cotton.	Total.	Declared value of Exports from Great Britain to India.†	Computed value of Cotton and PieceGoods Imported f'm India to Gt. Britain.
	Pieces.	lbs.	Pieces.	lbs.	Pieces.	lbs.	Pieces.	lbs.	lbs.	lbs.	£	£
	K.	L.	M.	N.	O.	P.	Q.	R.	S.	T.	U.	V.
1840	246,318	85,576,622	3,423	50,433,490	2,926 776	23,172,199	3,176,517	8,258,944	159,182,311	167,441,255	3,873,186	NO RETURNS.
1841	169,944	118,544,711	7,299	62,098,629	2,727,198	13,612,539	2,904,441	7,551,646	194,255,879	201,807,425	3,427,612	
1842	125,922	72,627.646	9,435	108,294,460	2,539,833	8,988,874	2,675,190	6,955,494	189,910,980	196,866,474	3,060,472	
1843	108,456	93,501,466	8,460	80,197,721	2,575,176	28,802,581	2,692,092	6,999,439	202,501,768	209,501,207	3,937,414	
1844	133,950	58,130,226	16,968	101,100,422	2,286,318	5,246,669	2,437,236	6,336,813	164,477,317	170,814,130	4,793,192	
1845	294,234	43,177,397	10,851	77,749,581	2,195,928	5,350,572	2,501,013	6,502,633	126,277,550	132,780,183	4,210,423	
1846	296,010	91,074,244	4,917	74,970,163	2,628,651	3,036,424	2,929,578	7,616,902	169,080,831	176,697,733	4,341,885	
1847	185,937	94,201,740	16,716	62,106,060	2,248,860	3,919,495	2,451,513	6,373,933	160,317,295	166,691,228	3,178,535	
1848	107,817	67,203,519	49,827	96,119,905	1,914,108	5,308,042	2,071,752	5,386,555	168,631,466	174,018,021	3,037,871	
1849	116,973	110,690,357	1,968	52,445,222	2,108,319	2,529,641	2,227,260	5,790,876	165,665,220	171,456,096	3,977,805	
1850	146,403	141,446,798	8,232	77,050,629	1,758,318	7,976,256	1,912,953	4,973,677	226,473,683	231,447,360	4,708,813	
1851	212,904	81,104,223	5,118	160,717,651	2,028,057	11,730,957	2,246,079	5,839,805	253,552,831	259,392,636	5,046,221	
1852	409,866	181,360,994	26,802	75,671,742	2,230,452	5,875,438	2,667,120	6,934,512	262,908,174	269,842,686	4,707,120	
1853	324,321	138,183,429	2,631	55,777,008	1,820,154	3,301,328	2,147,406	5,582,475	197,761,765	203,344,240	5,078,668	
1854	250,737	119,513,537	13,050	45,893,923	2,022,054	8,372,732	2,285,841	5,943,186	173,780,192	179,723,378	6,560,236	1,798,421
1855	110,838	170,771,610	4,677	56,691,112	2,082,192	9,717,427	2,197,707	5,714,638	237,180,049	242,894,087	5,842,974	2,327,528
1856	136,002	253,410,036	3,624	48,784,561	2,325,003	17,458,927	2,464,629	6,408,035	319,653,524	326,061,559	5,857,445	3,597,762
1857	104,949	197,221,247	88,980	20,524,119	2,122,146	42,608,686	2,316,075	6,021,795	260,354,052	266,375,847	6,083,266	5,519,669
1858	...	...	...	...	...	...	...	...	...	...	...	...

Note.—The weight of the Cotton Goods Exported to, as well as Imported from, India, from the impossibility of ascertaining the specialities of different qualities, is merely put forward as an approximate estimate; every care has, however, been taken to arrive at as fair a conclusion as possible. The determination is, in the first instance, based on calculations approximatively showing that each yard of Manufactured Cloth sent to India weighs on an average $3\frac{1}{60}$ oz.; and with respect to the Goods Imported from India that these weigh 3·09 lbs. per piece.

* Includes Ceylon, the Import of Raw Cotton from which, in 1857, was 2,036,832 lbs.

† Includes Ceylon and Singapore previous to 1848; not having been defined in Official Returns earlier than 1849.

TABLE III.*

	Population.	Total Value of Exports.	Value per head of Exports to each Country.		
		£	£	s.	d.
Russia—Northern Ports	67,000,000	180,249	0	0	0½
Southern Ditto	3,000,000	13,750	0	0	1¼
Sweden	2,864,831	54,637	0	0	4½
Norway	1,050,132	54,430	0	1	0¼
Denmark (including Iceland)	2,900,000	101,158	0	0	8¼
Prussia	15,726,820	27,245	0	0	0⅜
Mecklenburg Schwerin	20,000	60	0	0	0¾
Hanover	2,003,200	147,420	0	1	5½
Oldenburg and Knaphausen	241,000	...		...	
Hanseatic Towns.	384,000	3,064,380	7	19	7
Heligoland	2,000	2		...	
Holland	2,444,550	2,247,178	0	17	11½
Belgium	2,533,538	299,236	0	1	8¼
Channel Islands	143,126	48,292	0	0	6¾
France	36,897,152	155,710	0	0	1
Portugal Proper	4,530,000	664,363	0	3	0
Azores	271,416	49,552	0	3	7¾
Madeira	90,000	17,684	0	4	0
Spain—Continental and Balearic Islands	14,357,210	86,133	0	0	1¼
Canary Islands	200,000	65,275	0	6	6
Gibraltar	17,024	403,670	23	14	2¾
Italy, &c.—Sardinian Territories	4,890,000	306,783	0	1	3
Duchy of Tuscany	1,275,000	368,113	0	5	9¼
Papal Territories	2,500,000	159,776	0	1	3¼
Naples and Sicily	7,500,000	361,523	0	0	11½
Austrian Territories	7,835,000	341,469	0	0	10½
Malta and Goza	120,000	140,991	1	3	6
Ionian Islands	208,100	86,060	0	8	3
Kingdom of Greece	1,000,000	108,058	0	2	2
Turkish Dominions and Egypt	26,100,000	2,466,108	0	1	10½
Tunis	100,000	...		...	
Algeria	2,000,000	...		...	
Morocco, &c.	15,000,000	63,810	0	0	1
Eastern, Western, and Southern Africa, with the African Ports on the Red Sea, Cape Verde, Ascension, and St. Helena Islands	10,000,000	613,325	0	1	2¾
Mauritius	101,469	129,992	1	5	7¼
Aden	40,000	535	0	0	3
Persia	13,750,000	...		...	
Continental India, with the contiguous Islands	150,000,000	5,680,069	0	0	9
Islands of the Indian Seas—Java	5,000,000	448,265	0	1	9½
Philippine Islands	2,500,000	344,155	0	2	9
China	360,000,000	1,129,799	0	0	0¾
Hong Kong	20,000	278,634	13	18	7½
Japanese Islands	25,000	...		...	
British Settlements in Australia	2,695,000	1,040,521	0	7	8½
South Sea Islands	600,000	18,880	0	0	0¾
British North America	2,456,046	749,252	0	6	1¼
British West India Islands, and Guiana	944,800	395,026	0	8	4¼
Honduras (British Settlements)	14,600	56,865	3	17	10½
Foreign West Indies—Cuba	600,000	384,464	0	12	9¾
,, Porto Rico	461,200	4,917	0	0	2½
,, Guadalope	120,839	...		...	
,, Martinique	135,000	...		...	
,, Curacoa	31,000	11,978	0	7	8¾
,, St. Croix	...	...		...	
,, St. Thomas	8,000	295,708	36	19	3¼
French Guiana	...	...		...	
Dutch ditto	236,000	1,031	0	0	1
Hayti	860,000	76,474	0	1	9¼
United States of America	27,000,000	4,182,901	0	3	1
California, Mexico, and Central America	8,000,000	754,547	0	1	10½
New Granada	28,000	293,731	10	9	9½
Venezula	1,267,962	158,923	0	2	6
Ecuador	500,000	19,569	0	0	9¼
Brazil	6,000,000	1,788,366	0	5	11½
Oriental Republic of the Uruguay	860,000	264,442	0	6	1¾
Buenos Ayres	100,000	255,508	2	11	1¾
Chili	1,600,000	593,085	0	7	4¾
Bolivia	1,500,000	...		...	
Peru	2,000,000	658,315	0	6	6¾
Falkland Islands	12,000	200	0	0	4
Greenland, and Davis' Straits	20,000	...		...	
Total	825,690,745	32,712,002			
Estimated Consumption of Cotton Manufactures in Great Britain and Ireland	27,512,687	21,224,494	0	15	5
Totals for the World	853,203,432	53,937,396	0	1	3⅛

* Reprinted from Ellison's Handbook of the Cotton Trade.

can be sent into the market—so increase the present margin—as to make its cultivation a favourite, because remunerative.

On referring once more to Table I., in the first-mentioned places we find that where nature has provided the people with favourable means of exit, they have doubled their exports to meet our demands; in others, from want of these, with similar inducement during the same period, and with means for vastly extended cultivation, we find scarcely any increase; for with the present means of communication, it has been found impossible to do more than send down to the coast a few thousand bales instead of the hundreds of thousands required. With these facts in view, I hold it to be impossible to exaggerate the benefits likely to be derived from the improved means of transit which are either in prospect or in course of realization. Both the necessities of India, as well as the wants of this country, demand the speediest accomplishment of this, and require that no efforts shall be spared to conclude, as rapidly as possible, the works already commenced.

I admit the importance of all that is said with respect to the advantages arising from the double functions—cheap transit and irrigation—capable of being performed by canals; and I have endeavoured to show that by means of the latter only can we hope from many districts to obtain a supply of cotton. Our necessities are urgent. We have shown that extensive inland districts produce now an article fairly suited to our wants. Some of these, at least, can never be reached by either canals or rivers rendered navigable: by railways alone can this be effected. Take a practical view of the matter. We want cotton from Berar, and the Great India Peninsular Railway sends a branch through almost the heart of the country to Nagpore. Candeish will be so far affected by the same line and the Bombay, Baroda, and Central Indian Railway will, when completed, render the conveyance of the produce of Guzerat independent of the monsoon. Extending through a portion of the Deccan, we find the southern branch of the Great Indian Peninsular joining with the Madras railway, and giving exit means to the cotton of Bellary, and the produce likely to be developed along the course to the north.

In the south of the Peninsula, we find the Great Southern of India and the Madras line preparing to sweep in their course cotton districts which we have shown capable of supplying one-fourth of our present wants.

To Dharwar no line has at present been sanctioned, but to obtain cotton from thence the railway is essential. In the north-west, that portion of the East Indian not in connection with the navigable portions of the river, will greatly assist in removing the produce of the Gangetic Doab. The same end will likewise be accomplished by the Punjaub railway in the north, and by that of Sind in the south.

Practically, the railways first mentioned are those to which we must look for immediate help. Table IV., (p. 288,) gives us a condensed view of all essential particulars in connection with the different Indian railways, showing the length of line now sanctioned, the amount open, and that in course of execution. Thus, of the 4847 miles sanctioned, only 559 miles are opened, but 3038 are in course of execution; and we may rest assured that from the rapidly accumulating evidence of their importance, the utmost vigour will be exercised in their completion. It has been said, that, compared with the necessities of the country, the four or five thousand miles of railway now sanctioned will prove a mere drop in the cup of India's necessities, and that her wants are variously estimated at, from 20 to 30,000 miles of road. If we consider, however, in connection with our cotton wants, the difficulties which the lines alluded to are certain of overcoming, we must conclude that with a line to Dharwar these will prove sufficient, always sup-

TABLE IV.

INDIAN RAILWAYS.

Name of Company.	Direction of Line.	Length of Line Sanctioned	Length of Line Open.	Length in course of Execution.	Date when it is expected further portion of the line may be opened.	CAPITAL.		
						Estimated Amount.	Amount Sanctioned.	Amount Paid up.¶
		Miles	Miles.	Miles.		£	£	£
East Indian	Calcutta to Delhi* ..... Allahabad to Jubbulpore	1.100 300 Total 1,400	Calcutta to the river Adjai, and Branch to Raneegunge......... 143 Allahabad to Cawnpore... .. 126 Total 269	831 The works on the Jubbulpore Branch are just about to be commenced.	To Rajmahal by the end of 1860. To Allahabad end of 1861. To Delhi and to Jubbulpore end of 1862. (*This is exclusive of the large Bridges*).	12,731,000	12,731,000	9,611,905
Madras	Madras to the Western Coast at Beypore, with a Branch to the Neilgherries. Bangalore Branch...... Madras to Bellary......	430 80 310 Total 820	Madras to Goreatum... 96	334 Operations on the Main Line to Bellary and on the Branch to Bangalore will commence shortly.	To Beypore by end of 1859. (*Other Lines not estimated*).	6,000,000	4,000,000	3,181,200
Great Indian Peninsula	Bombay to Callian, with Branch to Mahim..................... Callian to Jubbulpore Callian, *via* Poonah, to the river Kristna Branch from Bhosawal to Nagpore ...	35 572 366 263 Total 1,236	Bombay to Wassind on the N.E. line, and S. E. to Campoolie—also from Lanowlie to Decksal. Total 194	1,042	To Sholapore, Sept., 1859. To Jubbulpore and Nagpore, 1862. Works on Bhore and Thul Ghauts, 1861.	10,000,000	8,333,300†	3,907,870
SIND: Sind Railway.	Kurrachee to Kotree on the Indus...	120	...	120	By the end of 1859.	1,000,000	1,000,000	708,057
Punjab Railway..	Moultan to Lahore and Umritser ...... Delhi to Lahore	230 260 Total 490	...	230	Lahore to Umritser, 1860, and to Moultan, 1862.	2,000,000‡	1,500,000	459,327
Indus Flotilla ...	For the Navigation of the Indus, &c., between Kotree and Moultan, in connection with the Railways	...	...	Boats are in course of being Built. One has been completed.	Expected to be in complete working order by end of 1859.	250,000	250,000	78,620
Bombay, Baroda, & Central India	Bombay, by Surat & Baroda, to Ahmedabad	322	...	322	Surat to Ahmedabad, June, 1859. Bombay to Surat, 1861.	2,500,000	1,750,000	841,531
Eastern Bengal	Calcutta to Dacca,§ with a Branch to Jessore	130	...	130	End of 1861.	1,000,000	1,000,000	336,227
Calcutta and South Eastern	Calcutta to the Mutlah	29	...	29	End of 1860.	250,000	250,000	57,000
Great Southern of India	Negapatam to Trichinopoly, ‖ with Branches to Salem and to Tuticorin ...	300 Total 4,847	...	Surveys of this Line are now being made.	Negapatam to Trichinopoly, 1860.	2,000,000	For the line from Negapatam to Trichinopoly, 500,000	40,000

SUMMARY.

	Miles.
Length of Railway sanctioned	4,847
Length of Railway open...	559
Length of Railway in course of execution	3,038
** Length of Railway expected to be open in 1859	747
Ditto in 1860	279
Ditto in 1861	2,076
Estimated amount of capital	£39,731,000
Amount paid up (January, 1859)................................	19,221,737

LIABILITY ON ACCOUNT OF INTEREST.

At $4\frac{1}{2}$ per cent. on	£500,000 (Capital)	£22,500	0	per ann.
At $4\frac{1}{2}$	,,	333,300 (Debentures) ...	14,998	10	,,
At $4\frac{3}{4}$	,,	1,000,000 (Capital)	47,500	0	,,
At 5	,,	87,897,700 (Capital)	1,894,885	0	,,
		Total...........	£1,979,883	10	,,

RAILWAY DEPARTMENT, INDIA OFFICE, January, 1859.

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* Including Raneegunge and Benares Branches.

† Including £333,300 Debentures.

‡ From the Line from Moultan to Umrister. No estimate has yet been made of the Line from Delhi to Lahore.

§ The Line is only sanctioned to the Ganges at present, but it is intended eventually to be carried to Dacca.

‖ The Line from Negapatam to Trichinopoly is all that has been sanctioned for immediate construction.

¶ In England to 31st December, 1858, and in India to the latest advices.

** This does not include those lines of the dates for opening which no estimate has yet been made.

posing that we do not forget to improve or create those less substantial internal means of communication, without which the general benefits to be effected by railways would be greatly crippled. And this leads me further to inquire whether we have selected the kind of railroad most suited to India's urgent wants? It has been stated, and many arguments have been brought forward to prove it, that these high-speed railways may suit the few first-class travellers, but are not fitted to develop the immediate wants of India. Looking to the kind of railway which has been adopted to form the main arteries of that great country, viewing these in relation to the vicissitudes of the climate, and the nature of the soil—the rain which converts the often stoneless ground into a pulpy tenacious mass, which makes torrents of the smallest rivulets, and in an hour's time lays square miles of valley under water; or regarding the internal necessities for communications by roads, by tramways, and paths of all sorts which will, in time, be made in conjunction with the main; and we must conclude, that that was a wise foresight which commenced with "permanent ways." High speed is but a concomitant of durability; and if we may be permitted to take warning, as well as example, from that so-called "model country" of the West, inquiry will show the mistake occasionally committed of making low speed and cheap communications in places where the main artery should have been, as nature makes it, strong and durable.

So far I have shortly indicated our present prospects of improved communications from railways, and while attaching vast importance to these, it must not be forgotten that hundreds of miles of our great rivers are likely soon to be rendered practically available for carriage purposes by the boats now in progress, and which will doubtless before long, in point of numbers, swell into flotillas. Again, vast works of irrigation have either been completed, or are likely to receive the extended attention and encouragement they deserve.

I trust I have now said enough to fully warrant the belief that, even supposing the measures now in progress were only to be carried out, incalculable advantages are certain to accrue both to India and to Britain. I have endeavoured to show that hitherto the supply of cotton from India has apparently been only limited by the transit difficulties of the country, for in the face of these we have seen it for years struggling to supply us from her abundance in the interior, and, in spite of all drawbacks, receiving some remuneration for her exertions.

With however the means of transit now in prospect, or capable of speedy realization—with railways and other projected sources of communication—giving scope to the law of production—affording wide-spread encouragement to industry—bringing the power of self-interest to bear directly on the cultivator—leading to his removal from the heartless grasp of the usurer, or of the "middleman"—in return for the fruits of the soil, placing at his disposal cheap and suitable products from the looms of the west—in better food, better clothes, and a more comfortable dwelling, letting him taste some of the sweets that labour ought to bring—and we feel justified in the conclusion we draw, that the day is not so distant, as some would think, when India will send us in abundance, not only cotton, but every product of the vegetable kingdom required either in manufacture or in art; and be considered, not in sentiment, but in reality, the brightest jewel—the real Koh-i-noor—of the British Crown!*

DISCUSSION.

The CHAIRMAN had listened with peculiar interest and pleasure to the admirable paper with which Dr. Watson had favoured them. About two years ago he (the Chairman) had the honour to read a paper before this Society, upon the question, "How are we to obtain increased supplies of cotton?" and he then pointed to India as the only country where cotton could be had in such quantities as our manufacturers required. He was happy to find that the views which he took upon that question were confirmed by so high an authority as Dr. Forbes Watson, who occupied the post which his esteemed friend the late Dr. Forbes Royle had so ably filled. Dr. Watson had told them that India produced at the present time 2,400,000,000lbs. of cotton annually—more than double the quantity produced by the whole of the United States of America. He had told them that Berar—the dark-coloured spot upon the map—produced the largest quantity and the finest quality of cotton; but, owing to the great distance from the coast, the cost of its conveyance by means of bullocks amounted to about three halfpence per lb. This was, no doubt, the great obstacle to the importation of cotton into this country from India. In America the cotton was brought down the Mississippi river, a distance of 1,000 miles, at a cost of one-eighth of a penny per lb. He had lately seen a gentleman who had surveyed the Godavery river, which joined the Wurda, and led to the district of Berar. That gentleman had informed him that this river might be made navigable at a small expense, and he had no doubt, if this could be effected, that cotton would be brought from those districts, the carriage from which cost now three-halfpence per lb., at one-tenth of that price. That was one of the most important facts that he had heard relative to the imports of cotton from India. They would see that if cotton could be brought to the ports of shipment at a penny per lb. less than at the present time, this would enable the purchaser to give a penny a pound more to the grower; and there could be no question that if three-halfpence per lb. was a remunerative price, two-pence per lb. would induce a great increase in the growth of the article. He entirely concurred in the view that Dr. Watson had taken—that the future of India was a bright one—if that country were governed with wisdom and justice, and if the means of internal communication were opened, the riches of India would cease to be fabulous, but, in the language of Dr. Watson, it would prove "the brightest jewel—the real Koh-i-noor—of the British Crown."

Mr. J. G. FRITH remarked that the subjects brought forward in the present paper were deserving of the utmost consideration, and it must be generally agreed that no more deeply important question could be brought under the notice of Englishmen. The extent of the productions of India was comparatively unknown at the present day. He believed the statement of Dr. Watson as to the price of cotton on the spot was quite correct, but, unfortunately, that price did not go into the hands of the poor ryot, but a large portion of it was taken by the middleman, through whose hands it passed before it arrived at the port of shipment. The expense of conveyance was very great; from Berar to Bombay the cost was fourpence per ton per mile, but that varied according to the season. In the meantime, owing to the long time occupied in the transit, the article was subject to great deterioration, and it generally arrived in a very filthy state at Bombay. When the system of railway communication in India was perfected, which he hoped would be the case in a few years, he believed the cotton would be brought from Berar to Bombay at an immensely reduced rate, and the conveyance would probably be effected in less than forty-eight hours. The interior trade in cotton needed great improvement, and he thought when the means of transit were more perfect, and persons went armed with rupees, and dealt with the ryots themselves, the quality of the cotton would be improved, and more confidence given to the grower. With regard to the question of the relative suitability of railways and canals for India, he believed the resources of that country were so great that there would be ample employment for both, to the advantage both of the country itself and of England.

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* The author would direct particular attention to Table II., which contains many points of interest which it has been impossible to touch upon within the limits of the present paper.

The Chairman remarked that Dr. Watson had referred to India as capable of producing a great variety of articles besides cotton. The manufactures of this country were increasing at such rapid rates, that the consumption of most of the raw materials had overtaken the production. There was a scarcity of hemp and flax, and of a variety of textile articles; and he would take that opportunity of suggesting to Dr. Watson, that on some future occasion he should favour them with a paper upon some of the other valuable products of India, for he was sure such a communication would be of great interest to the Society and our manufacturers.

Dr. Riddell said there could be no doubt whatever that India was capable of producing cotton to any amount; but although cotton might be grown in India at a cost of 1¼d. or 1½d. per lb., yet the poor ryot—the cultivator—would receive no benefit to himself, even if the cotton fetched 2½d. per lb. The ryot, working himself and all his family, earned not more than what was equivalent to 2s. per week. What could they expect under such a miserable system? The ryot was ground down by persons who advanced the money to enable him to grow the cotton, a certain quantity of which he was bound to supply; and if in any particular season there was a falling off in the crop, the weight was increased by dirt and other adulteration, in order that the quota of cotton might be furnished to the parties who had bargained for it even before the crop was grown. In the district of Berar there was an extent of land capable of growing any amount of cotton; but he would not have them deceive themselves by supposing that if they sent the seed of the Sea Island or Bourbon cotton it would necessarily flourish in that part of India. It was no such thing. The black soil of the country would grow very abundant crops of the indigenous cotton, but it was not suited to the finer qualities. No doubt the finer cotton might be grown where the climate and soil were adapted to it. Some descriptions of cotton required the sea air; some required more moisture; others less. Now, in the valley of Berar, there were two descriptions of cotton grown. One was planted in June, and gathered in November or December; that was the most abundant and the cheapest; but the cotton sown in the month of March, although not so abundant, was more profitable to the cultivator, owing to its being of a finer quality. So much for the indigenous cotton of India. In looking to that cotton, it would be found to be of the green seeded description, the same which he had no doubt had been originally taken to America, and he thought it would be a most valuable experiment if either the Government or some private individuals would take some of the indigenous cotton seed from India and give it a fair trial in America, and, after three or four years, report upon its growth. He had no doubt that cotton would be equal to any that was sent to this country. The cotton seed sent from America deteriorated when continuously grown in India; he was satisfied of that fact from his own experiments; nevertheless being of a longer staple, it was more valuable than the indigenous cotton. The Sea Island cotton was a description that could not be grown to the best advantage without the influence of the sea air. At the same time, no doubt it could be grown in many parts of India, and even in Berar. He had had letters recently from influential persons in India, informing him that the exotic cotton was being extensively cultivated. The seed had been sent from Calcutta and Hyderabad, but, it being late in the season before it arrived, the yield was small, although what was grown was of good quality. From what had been done by the Cotton Supply Association of Manchester, they might hope in a year or two to have most favourable reports on this subject, and such as would satisfy them whether or not exotic cotton could be grown with advantage in Berar. A few days ago he received some samples of cotton from Berar, the produce of seed from Egypt. In looking at that cotton he found it was the green seeded cotton of the uplands of America. He had sent a specimen of it to Mr. Bazley, at Manchester, whose valuation of it was 10½d. per lb. That cotton was grown in the centre of Berar. The question was—would that seed, if grown there for several years, deteriorate? His opinion was that it would; for it was well known that if seed of any description was grown continuously in the same soil, it always deteriorated. From his own knowledge of the growth of cotton, he was satisfied that the fresher the seed was the finer would be the cotton; and he recommended that wherever seed was grown in any part of India, it should be exchanged every second or third year for the seed from other parts. Another point was the necessity of preventing the seed and plants of inferior species from being mixed with those of a better kind, for where this occurred hybrids sprung up, and an inferior quality of cotton was produced; but, with a remuneration of 8s. per month, was it to be expected that the poor ryot would pay any particular attention to this matter? It must be done by men of science—men who would devote their time and energies to it, and who would make up their minds to attend strictly to their business. The cotton to which he had already called their attention as having been grown from seed sent from Egypt, was of the green seeded description, whilst the finest Bourbon and sea Island cottons were black seeded, but these were valued at from 1s. to 1s. 3d. per lb. He therefore said that what they had more particularly to attend to was the acclimatization of the plant, and the sending the seed to those spots where that particular description of cotton would grow. When seed was sent to India for the purpose of being experimented upon, they ought to consider the place to which it was to be sent. In the upper parts of Sind, the yield per acre was 136 lbs. of cotton and seed together, and of clean cotton 33 lbs. per acre, which bore the proportion of about three-fourths seed to one-fourth of clean cotton. Going to Hyderabad they found that instead of 136 lbs. of seed and cotton per acre, they had no less than 395 lbs. per acre. How was that to be accounted for? Simply from the climate; for he found that exotic cotton grown at Shikarpore, produced only 24 lbs. of cotton and seed together per acre. That was owing to the climate being unsuitable. It was not through a want of water, for the plants were abundant, but when the plant arrived at a certain stage of growth, it fell off and withered away, producing no seed. When the railways now under construction were carried out, he had no doubt that Berar alone would be able to supply the Manchester manufacturers with as much cotton as they required.

Professor George Wilson (of Edinburgh) said, having had the honour of filling the chair of a sister society to this in Scotland for the last two years, he begged to express the pleasure he felt in attending this meeting, and the sympathising look which his own Society cast towards her senior and more famous sister here. He would also express the great delight with which he had listened to so instructive a paper from his friend Dr. Watson, whose acquaintance he owed to the fact of their both being connected with Industrial Museums. He looked with great interest to these Industrial Museums, which were, in fact, becoming schools for our countrymen before going to our foreign dependencies, in which they became familiar with the various raw materials produced there, so important to the manufacturers of this country. A growing interest was manifested on this subject, and he could mention that six young Indian officers, who had experienced the horrors of Lucknow and Cawnpore, were now spending a great portion of their leisure time on furlough in studying these matters, in order to fit themselves for turning to better account the industrial resources of India upon their return to that country. He had been struck with the identity of their remarks with those of Dr. Watson and Dr. Riddell, inasmuch as it was admitted that the two great points of difficulty in India were the want of means of transit and the necessity for a larger amount of intelligence than the natives possessed, in the collection of the raw material. He was pleased to hear that there was a probability of the difficulties of transit being soon overcome. He was also gratified to find, from the numerous letters he received from Bombay, Madras, Calcutta, &c., that there were intelligent men in those parts who were seeking to interest the natives in this important subject, and he could not but rejoice that so much community of feeling existed as to what was proper to be done in this matter. He had recently received a communication from Dr. Alexander Hunter, of Madras, who, being aware that this subject was to be brought forward, had requested him to state his (Dr. Hunter's) conviction that cotton might be very largely cultivated in India, and its present quality much improved; and also to urge that persons of a higher intelligence than that of the natives should be sent out to look after the collection of the raw material. He hailed the present intercommunication of ideas upon this subject as an omen for good with regard to the cultivation of cotton in India; and he cordially joined in the hope expressed by the Chairman that on a future occasion his friend would favour them with a paper upon the other important products of that country; a subject of so much interest to the manufacturers of England.

Mr. A. C. Brice said he had had considerable experience on the subject of cotton growing in India. He had been in the centre of India, amongst the natives, doing that which the merchants of England were charged with not having the enterprise to do, namely, buying cotton direct from the producer. The question of the production of cotton in India was not one of soil only, and of the means of transit,—there were numerous other important points bearing upon the question. Dr. Watson had stated his opinion that India produced more cotton than the whole of America; and this view, from so high an authority as Dr. Watson he (Mr. Brice) desired fully to endorse. India had not only the means of supplying herself with cotton, but had the power to export, which power was crippled, however, by the want of means of sending the cotton to the seaboard. He (Mr. Brice) had selected Dharwar as the most favourable locality in which to settle. The house which he represented had been established in India five or six years with some success, but also with considerable disappointment. It was not simply necessary that he should go there and say he was ready to buy cotton; but he had to carry his bag of rupees upon his back, and to travel hundreds of miles with no resting place except the ground. He had to weigh the cotton himself in little lots, and when he had bought it, he had no place to warehouse it. Sometimes he placed it in a temple that had been abandoned by the natives, but then he found he had no means of getting it down to the coast. The difficulties in the way of increased production of cotton in India would be understood when he told them that, from the time the seed was put into the ground, in some cases, more than two years elapsed before the cotton reached Liverpool. In the meantime the increased production in America, which stimulated the cultivation in India, had been followed by a large crop; and the natives in the interior found their large stocks of cotton almost valueless. They had no warehouses to put it in, and no labourers to clean it. The consequence was, it became deteriorated in quality, and much of it was injured to such an extent that it might have been taken for Nankin cotton, so thoroughly smoke-dried was it. The absence of labour in India was a considerable difficulty. It took 750 hard-working women to clean a ton of cotton in a day; they would therefore imagine how slow the process was. It was not simply a question of monetary arrangement, of land tenure, or of modes of transit, but there were an infinity of other elements which entered into the question why merchants had not, and must for some years to come be deterred from, carrying their operations into the interior of India. When he (Mr. Brice) had succeeded in obtaining a tolerable footing in the country, he had to establish his own line of traffic; and he managed for a short time only to send in a few hours what took the natives many days; but rains, dry winds, and sunshine soon stopped all those arrangements. The cattle could not get food; the roads were three inches deep in powder, and from a mistaken policy the government allowed a sort of plough to work upon the road, which had been made at an expenditure of thousands of pounds. For the last eighteen months or two years the traffic in that part of the country had entirely ceased, owing to the state of the roads. India was capable of producing—and, when the railway system was opened out, would produce—as much cotton as the manufacturers of England could manage to consume and pay for. But here we came to another difficulty. The exports of India were paid for about half and half, by goods and specie. Some three or four years back, when our imports from India were 27 millions, we fancied we could manage to pay India with five millions of specie. As we increased our imports in value we had in the like proportion to increase our exports of specie. In 1857, when we got to 42 millions of imports, we had to send back 22 millions of specie. Could England, therefore, afford to import more cotton from India unless some means were devised to pay for it, other than as at present, by 20 millions ot specie. The exports to India in the exceptional period to which he was referring, amounted to only about 8d., 6½d., and 4d. per head of the population in the respective presidencies. That was a proof that India did produce large quantities of manufactured goods for her own consumption. In the little island of Ceylon they imported goods to the amount of 2s. 6d. per head, and in the Mauritius the amount was still higher. This showed what India might consume, and what England might export, if the trade were properly developed. It was even now the case that our twist competed in the market with the home-spun twist of India; and some of the articles exhibited that evening were English warp and Indian weft. The cotton grown in India could not be spun and supplied to the weaver so cheaply as they could sent it to England to be spun, and send it back in the shape of twist. The power of export from India was incalculable, but our power to pay for it was limited. If we wished to obtain the means of supporting our shipping, of supporting our merchants, capitalists, and mill-owners, it must be by efforts to get our goods into the interior of India, and draw their cotton out. There was no doubt, then, that very large supplies of cotton could be obtained from India, and all doubt upon the matter was removed when he told them that the cotton now selling in Liverpool, and which was quoted in India as the highest quality, could be produced for 1¼d. per lb., and by means of railway transit could be shipped and sold at Liverpool at 3½d. per lb. at a profit. The natives were becoming aware of this. The cultivation of exotic cotton had increased from 40,000 acres to 80,000 acres in four years, and he believed at the present time the cultivation of exotic cotton extended over 150,000 acres. 20,000 bales had already been shipped, and the quantity would have been greater, but that the indigenous and exotic cotton were planted together. What was wanted was an arbitrary government in India. The present pernicious system of contracts and forestalling the markets should be abolished. Up to the present time the government had been not only an arbitrary, but a paternal one, perhaps too much so, for Europeans could hardly get a satisfactory settlement of a judicial matter. He earnestly hoped this very interesting subject would come under consideration again before long, for it was too important to be neglected.

Colonel Sykes, M.P., would bear testimony to the accuracy of the views of Dr. Watson in general, and he begged to thank him for the elaborate paper he had communicated. The supply of cotton to this country from India was a question of price alone. Anterior to the period embraced by Dr. Watson's tables a diagram was prepared by the late Dr. Forbes Royle (which he held in his hand), in which he showed that as the price of American cotton rose in the market here, so did the price and supply of Indian cotton increase; and as the price of American cotton fell, the quantity of Indian cotton fell in a corresponding degree. Had the price been kept up at the maximum there would have been a maximum supply from India. The ascents and descents of the quantities, as shown upon that diagram, were truly marvellous. They would scarcely suppose that there had been a supply of 30 millions of lbs. this year in consequence of an increase of a halfpenny or a penny per lb., and if that continued he had no doubt the quantity would rush up to 100 millions of lbs. next year. The fact was, when cotton was at a price of 3½d. per lb., instead of coming to England it went to China, where they got a better price. Therefore, as far as the supply was concerned, there was no doubt India could furnish it, provided the price was remunerative. It was not the cultivators themselves who supplied it, but the intermediate agents. The cultivator got his three halfpence per lb., and there all advantage to him ceased. It then came into the hands of other persons, and so found its way gradually to the coast at an augmented price, through the accumulated profits of the agents through whose hands it passed. When there was a want of indigo it was thought worth while to send out Europeans to get it, and they got land in Bengal for its cultivation. These were in the "dark" days of the Company's government, when it was said that Europeans were interdicted from going into the country; but, nevertheless, those persons somehow contrived to get land. The indigo had increased in quantity consistent with the demand in this country and in Europe generally. How was that? By those who wanted it going after it. It was the same with sugar. It had increased from small beginnings to an enormous amount. It was thought worth while by some European houses to send out agents to India, to go into the villages and collect the sugar, until it was put on board by hundreds of thousands of tons. Why should not the people of Manchester do the same when they wanted cotton, as had been done in the cases of indigo and sugar? The government of India never prevented them going there.

The Chairman.—There were no roads for the traffic when they got there.

Colonel Sykes.—If the roads were sufficient to bring sugar down 1,200 miles, surely the cotton could have found its way down; and it had done so to the extent of 250 millions of lbs. in one year. There was no question that they could get the cotton, if those gentlemen who raised the outcry against the Indian government would pay a proper price for it; but the wheel stuck in the rut, and, instead of helping themselves, they called upon Hercules to assist them. With regard to the introduction of arts and manufactures into India, he could say they were introduced when our own ancestors were savages covered with blue and red clay. With regard to European capitalists getting land in India, he thought they must agree that there was no difficulty about that. He found himself in a hornet's nest when he asserted, on a former occasion, that since 1839 any European could go into India and take land upon reasonable terms. It was objected that there was no fee-simple in the land, but the tenure was for 99 years, and surely that was tolerably well for one man's lifetime. Some of his friends were very anxious upon the subject of river and canal navigation in India. There could not be a doubt that railways would be of the greatest advantage, but as regarded lines of any great length in the interior, considering the expense of European as compared with native superintendence, it would be a question whether a railway could carry bulky articles like cotton as cheaply as by water carriage; but that was a question for the future to decide. They knew that when railways were first started in this country canal property became depreciated 40 or 50 per cent., from the notion that a railway running through the district of a canal would carry off all the traffic. But experience had proved that railways could not economically carry very heavy materials over very long distances, and the canals had consequently kept up their former value, even if they had not gone beyond it. The same might occur with regard to India. He had taken a warm interest in the establishment of the first steamers on the Ganges, and although three or four parties were almost ruined by the enterprise, yet that very canal company had received in one year 100 per cent. dividend. It was to be remarked, also, that Bourne's system of train boats had been placed upon the Indus, and he had no doubt that great advantages would result from it. But with regard to the Godavery he was afraid the Chairman had not carefully studied the survey he mentioned. There was ready means of access to the Godavery, but when they got to the feeders of that river, the country was of such a nature as to involve considerable falls, which he feared there would be great difficulty in getting over. He had no doubt that engineering skill could overcome all natural difficulties, but he was afraid the expense of rendering the Godavery navigable would be a great obstacle in the way of that project.

The Chairman could inform his hon. friend that he expected evidence to be given before the Indian Colonization Committee of the House of Commons, to show that it was perfectly practicable at a small expense. He now begged to propose a vote of thanks to Dr. Forbes Watson for his very able paper. He would suggest to those who took an interest in India to consult the reports and evidence given before the Indian Colonization Committee, which was now sitting. If he were himself a young man seeking his fortune, there was no part of our colonial possessions he should so soon go to as to India; and in his opinion no part of her Majesty's dominions offered such advantages to young men in that position.

A vote of thanks was then passed to Dr. Forbes Watson.

The paper was illustrated by a large collection of cotton fabrics of Indian manufacture, with specimens of the different varieties of Indian cotton, lent from the Industrial Museum at the India House. These articles will remain at the Society's House till to-morrow (Saturday), for the inspection of members and their friends. Mr. Thomas Clegg, of Manchester, contributed a case of specimens, showing the various qualities of cotton and seed produced in different parts of the world. Mr. Charles Garnett, of Cleckheaton, and Mr. W. Jameson, of Ashton-under-Lyne, exhibited varieties of cotton gins which they have presented to the Society.

The Secretary announced that on Wednesday next, the 30th inst., a paper by Mr. S. Alfred Varley, Assoc. Inst. C.E., "On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure Rapid and Certain Communication," would be read.

The following letter has been received by the Secretary since the meeting:—

Sir,—In his valuable paper, Dr. Forbes Watson has referred to the experiments in long-stapled cotton by Dr. Archibald Campbell, at Darjeeling, in Sikkim. I regret that I have received no recent information on this interesting subject, but it is very likely the whole question as to cotton in that country will be included in the returns now on their way to me for the purpose of presentation to the Committee of the House of Commons on Colonization. The success of the tea plantations has lately very much engaged the attention of the Darjeeling settlers, but the cultivation of cotton in the low grounds is not lost sight of, for I lately received a copy of a dispatch in which Dr. Campbell, the superintendent, has directed specimens of American upland cotton to be transmitted for experiment.

This brings me to another topic, which has received frequent illustrations in Dr. Watson's paper—the difficulty of communication, for the specimens of cotton seed will be weeks traversing a distance of 340 miles, in one of the most populous countries in the world. Were they sent express they would take seven days, and cost from 1s. to 1s. 6d. per ton per mile.

The first necessity to be supplied to promote the cotton cultivation, or any other branch of industry, is the provision of railway communication, and without railway communication in many parts of India even roads cannot exist, for, as Dr. Watson states, there are whole regions without metal or roadstuff, which, however, exists abundantly in the hill regions, and can be cheaply conveyed by railway. Thus Darjeeling, for instance, would supply lime and building stone to considerable districts of the low country were there suitable transport.

The next great step for the promotion of all branches of industry is the promotion of English colonization in the hill regions of healthy and temperate climates, whence English capital and English energy can be brought to bear on all parts of the country. This great influence will soon be extensively felt, for colonization is making steady progress. The accounts I receive officially from Darjeeling correspond with those from the other districts: railway communication is advancing towards the hills; and the boon promised this session by Lord Stanley, of an upset price for waste land, and a fee-simple tenure, as in the other colonies, will give a great impulse to the extension of English settlement.

I may take this opportunity of observing that I shall be happy to give any information in my power to intending emigrants, or to obtain for them authentic advice from the spot as to the employment which can be obtained for their labour or capital.—I am, &c.,

HYDE CLARKE,
Agent for the British Settlers in the Darjeeling Country of Bengal.

42, Basinghall-street, E.C., 24th March, 1859.

SOLDER FOR ALUMINIUM.

M. Mourey has described to the Société d'Encouragement in Paris, a process which he invented for soldering aluminium. He adopts an ingenious device for this purpose. In the ordinary way to solder two metals or two pieces of the same metal, all that is necessary after having prepared the two surfaces which are to be brought together, is to cover them with solder and to heat them. This mode of proceeding does not succeed with aluminium. M. Mourey prepares each of the two surfaces with a first solder, an alloy of aluminium and zinc, and then interposes between the two surfaces thus prepared another alloy richer in aluminium. In this manner the first alloy adheres to the aluminium itself, and the second alloy to the first, and thus a perfectly solid and continuous whole is obtained.

The surfaces to be soldered are prepared by being smeared with a mixture of turpentine, balsam of copaiva, and lemon juice, then placed on hot coals, and into the parts where the soldering is to take place, the flame of a gas lamp or self-acting blowpipe is directed.

Small pieces of an alloy of 6 parts of aluminium and 94 of zinc, are brought into contact with the prepared surfaces; these melt and adhere to the surfaces, being pressed against them by small tools made of aluminium. This operation is a rapid one; it requires, like any other soldering of this kind, a certain amount of care, but not more than in the hard soldering of copper. In each case a skill and knack are necessary on the part of the workman, as well as care in adjusting the temperatures, for the melting point of aluminium and zinc are scarcely 100° apart, and there is a fear whilst melting the solder lest the article itself should melt at the same time.

When the two surfaces have been thus prepared they are brought together, and kept in contact by iron wires, pincers, &c., as in ordinary soldering; pieces of the hard solder (80 of zinc, 20 of aluminium) are then placed at the points of contact, and the heat from a lamp is then applied, and the second solder melts, runs in, and adheres to the two layers of soft solder, and thus forms a strong joint.

The articles thus prepared are sufficiently strong and homogeneous to allow of their being reworked, and the joints will bear filing.

PATENT OFFICE RULES.

The following rules, in respect of communications from abroad and provisional specifications, have recently been issued:—

I. In any application for a Patent which is stated to be a Communication, the declaration must state the name and address of the party from whom it has been received, in the following manner:—

No. 1. When declaration is made in the United Kingdom,—

"That it has been communicated to me from abroad by [here insert name and address in full]."

No. 2. In other cases,—

"That it is a communication from A.B., a person resident at [here insert address in full]."

II. All Provisional Specifications must be written on one side only of each sheet.

(Signed) FITZROY KELLY, A.G.
H. M. CAIRNS, S.G.

Home Correspondence.

INTERNATIONAL EXHIBITIONS AND TRADE-MARKS.

Sir,—The Exhibition of 1851 took Englishmen and English manufacturers by surprise, and cannot be said to have been an absolute representation of British industry. The Exhibition of 1855, in Paris, was another universal Exhibition, of which English manufacturers did not take adequate advantage, as the following quotation from the official report of the Leeds' Chamber of Commerce to the Board of Trade proves:—"The manufacturers of glass, silk, pottery, stoneware, and other considerable items of Leeds production, had no representation whatsoever, which is much to be regretted, as the opportunity may not speedily occur again of bringing so completely under public notice the varied character of the industry of the town and neighbourhood, respecting which the ordinary notion is probably confined to the knowledge of a large trade in woollen goods."

The report, by Mr. J. Evelyn Denison, on agricultural implements, &c., to the Board of Trade, opens as follows:—"It was quite time that France and England should be better known to each other, and that it should be made apparent what great benefits would accrue to both countries from an improved acquaintance and extended intercourse."

"Up to 1851," says M. Léonce de Lavergne—a French writer, of high authority, and the author of *Essai sur l'Economie Rurale de l'Angleterre, de l'Ecosse et d'Irlande*,—"in France, more, perhaps, than elsewhere, notwithstanding our close proximity, an opinion had prevailed that in England agriculture had been neglected in favour of trade and commerce."

"The tariff regulations of Sir R. Peel, not well understood in their design or in their consequences, had tended to fortify this assumption. Nothing, therefore, created more surprise than the vast collection of agricultural implements which the Exhibition of London contained, and the proof they afforded of the high development of agricultural skill and science in the United Kingdom."

It has been reserved for the Paris Exhibition of 1855 to give new force to these impressions; to carry into the heart of France, and to display before the eyes of hundreds of thousands of spectators these evidences of the skill of our machine makers, placed in immediate contrast with the works of their competitors from all quarters of the world. The approach between the two nations, which was invited by the Exhibition of 1851, has been advanced and quickened by the Exhibition of 1855.

It was reserved for the Exhibition of 1855 to show that, by the use of improved implements in the tillage of the land, the produce of grain in England, per acre, is double that of France, and the English produce is three times that of France in saleable value. "Taking all products into account, animal and vegetable, it appears that the produce of England per hectare nearly doubles that of France."

In the report of the Belfast Chamber of Commerce to the Board of Trade, on the French Exhibition of 1855, I find the following statements:—

"The linen manufactures exhibited embraced a large range of qualities and prices, and nearly every nation in Europe had a fair representation of its various fabrics."

"Wurtemburg, Saxony, and Rhenish Prussia exhibited a great variety of fabrics, from the coarsest to the finest. The low and medium goods were similar to our own, but they exhibited specimens of very fine linens, which, we fear, our manufacturers will have difficulty in equalling, being made of fine hand-spun yarn, regardless of expense, for the Russian market.

"One piece equal to a 3,800 4-4 was 15*s.* 0*d.* ⅌ yd.
" " 2,800 4-4 " 6 9 "
" " 2,600 4-4 " 3 9 "
" " 2,400 4-4 " 3 4 "

"In the linens made for exportation, *they imitate the Irish marks and finish, and in many instances even the same paper ornaments used by the Irish trade.* This is an interesting phase in the history of the linen trade—that Germany, from whom we borrowed the names of a great variety of our linen fabrics, and still export them under these names, is now, in its turn, borrowing from us, and imitating our goods both in names, materials, and finish."

I am led to send the foregoing quotations, as the latter, more particularly, was recalled to my mind upon reading the report, in the *Journal*, of Professor Leone Levi's paper on "Trade-marks." The author of that paper says, "The lofty position gained by the British manufacturer in the markets of the world is, indeed, one of considerable difficulty and delicacy. Exposed to open competition both at home and abroad, it is not sufficient for him to have secured such a position by dint of industry and perseverence—he must maintain it by continued efforts towards absolute excellence."

It is evident that our manufacturers are fully alive to the importance of International Exhibitions, as affording them opportunities for displaying the degree of perfection to which they have attained, and of extending a knowledge of their power of producing classes of goods in reference to which their skill, as producers, is comparatively little known. It is also evident that exhibitions raise England in the estimation of foreign countries in departments where she had previously been supposed to be in the rear of her competitors.

In conclusion, I would suggest to the Council the practicability of making use of the forthcoming Exhibition of 1861 as a means of extending the International Copyright in Trade-marks, should Government fail to conclude treaties with foreign countries before that date; and then we shall have to record that International Exhibitions will have added one more to the many claims they already have upon our support as a manufacturing and commercial people, by tending to induce a higher moral tone among trading communities.

I am, &c., S. THOMAS.

PRODUCTS OF THE COMBUSTION OF COAL GAS.

Sir,—I perceive that three errors have occurred in the numbers given in my communication at page 274 of the *Journal*, and I shall be greatly obliged if you will allow me to correct them.

About the middle of the fourth paragraph in the first column, at page 274, it is said that 521 grains of ammonia are required to neutralize the acids formd by Mr. Thompson's proportions (1,191 grains) of sulphur in 1,000 cubic feet of gas, but the proper quantity of ammonia is 1,265 grains.

Again, in the second note, at the foot of the same column, the references should be to pages 358 and 474 of Vol. II. of the *Journal of Gas Lighting*, and the subsequent pages refer to the third volume of that journal.

Lastly, the second reference at the foot of the second column should be to page 502, and not 302 of the *Journal*. I might here also take the opportunity of saying, that in quoting Mr. Lewis Thompson's accounts of the variable proportions of sulphur in coal-gas, I ought not to have omitted a very emphatic statement of his at page 455 of the third vol. of the *Journal of Gas Lighting*, where, in his comments on a report of mine to the Corporation of London, he says, "I have all along had a strong suspicion that Dr. Letheby did not know how to determine the total amount of bi-sulphuret of carbon existing in coal-gas, and his last report demonstrates the correctness of my suspicion; he is, indeed, altogether very ignorant upon the subject of gas. Thus, the *utmost* amount of anhydrous sulphuric acid which he has ever been able to obtain has not reached higher than 212 grains from 1,000 cubic feet, whereas the *smallest* I am in the habit of procuring from the same bulk of gas is nearly 400 grains. But, if he will follow the proper course, he will discover that all his conclusions are worthless on this head." Now, as I have no doubt that a great deal of special pleading, and perhaps also of abuse, will still be used to show that I am altogether wrong in my conclusions; and as I know that the utmost is always done in such cases to distract attention from the general and the main facts, by commenting on the particular affairs of an error in numbers, &c., I am anxious to correct what would otherwise be very unimportant errors in my former communication.—I am, &c.,

HY. LETHEBY.

Laboratory, London Hospital, March 19, 1859.

TRADE MARKS.

Sir,—The history of modern times goes more and more to show that the nations of Europe, if not of other parts of the world, seem but to form one and the same family, bound together by ties of the strictest *solidarité*. We see that whatever affects the welfare, moral or physical, of one member, is likely, nay sure, to produce a more or less immediate shock in the different links of this great electrical chain of human beings. Though Montesquieu's aphorism, *Verité en deça des Pyrenées, erreur au delà*, still holds good in some respects at the present day, and although no common or universal standard of absolute morality has as yet been discovered, yet an unbiassed mind cannot fail to discover a certain hallowed ground, on which all petty feuds cease, and where a kind of *Treuga Dei* reconciles and unites minds the most apparently discordant. The exposure of wrongs committed among private individuals, or large masses of men, called nations, tends no longer to foster feelings of animosity and revenge *quand même*, but must be considered as a mere philanthropic process of laying open wounds which cannot be cured otherwise than by using freely, but skilfully, the scalpel of anatomical moralists and legislators.

That process was most ably followed in Professor Leoni Levi's late paper on trade marks, and in Sir Richard Bethell's able summing up of the same. Evils were expounded on that occasion amounting to nothing less than theft, or violation of hard-earned property, and which, as such, ought to be put down by general acclamation. It could not be otherwise but that the bearing which our relations with foreigners have on the subject should have been brought to light, and that immoral deeds perpetrated abroad should equally be branded with the reprobation cast on sins committed at home. "Iliacos intra muros peccatur et extra." Such a large share of censure was given to Prussia as would stigmatize her arms, "Suum cuique," with the expletive *rapuit*. No information, however, having been given about the actual state of things respecting trade marks in that country, it may perhaps be subservient to the noble design of promoting morality in commercial transactions by means of international treaties, to give a summary of the present Prussian legislation on that subject.

The principle followed in Prussia for the protection of trade marks is contained in the resolutions carried at the general conference of the Zollverein, held in 1838 at Dresden. That principle lays down that only such articles and trade marks shall be protected as consist of the name of the individual or firm, and address, or the manufactory of the respective tradesman or manufacturer. Accordingly, the law promulgated in Prussia, on the 4th July, 1840, brought infractions of that regulation under the criminal law (Par. 269). It moreover abolished the legal right to emblems, marks, &c. A great opposition, however, having been raised in the Western and Rhenish Provinces (where several thousand such marks are current for mere iron and steel articles), the latter provision was abrogated by the Government on the 28th May, 1842; and on the 18th August, 1847, a special law was promulgated for the protection of trade marks on iron and steel articles manufactured in the provinces of Westphalia and of the Rhine, the provisions of which were enlarged in some respects by an ulterior law, dated 24th April, 1854. Thus the Prussian legislation respecting trade marks may be summed up as follows:—

Trade marks for all kinds of articles are protected in the whole monarchy, provided such marks consist of the name of the individual or firm, and the address, or manufactory of the manufacturer; protection, moreover, is extended to all figurative and emblematical marks on iron and steel articles manufactured in Westphalia and the Rhine provinces.

To resume, the question of international laws regulating the use of trade marks and of original designs, patterns, and inventions as well, is a vexed one, since, as Horace has it, "Quot capitum vivunt, totidem studiorum milia." But, at the same time, it is an important one, and next to vital, since it has such a bearing on public morality. We therefore must not wonder at seeing that question incessantly mooted in every civilized community, and giving rise to "pia desideria" without end.* As for the difficulty of solving that problem, it is well known that the question, too, of literary property, was, some years ago, considered as almost insoluble in an international point of view, and yet at the present day we find the exclusive right to such property, without distinction of origin, acknowledged by states—as Belgium, Holland, and Switzerland—whose daily bread almost was piracy of literary property, and whose present book-trade, nevertheless, is in quite as flourishing, and certainly in a sounder, state than before the conclusion of international treaties which put an end to the vile system of counterfeits. As for the extension of such a benefit, I have every reason to believe that no enlightened Government will be reluctant to enter upon negotiations for the protection of a property which partakes both of an intellectual and material character, since the conclusion of such international treaties may be made not to interfere in the slightest degree with the autonomy of each independent state. "Il est bien facile," said Frederick the Great, "de se représenter une chose comme impossible, mais si on entre en action, il y aura mille facilités auxquelles on ne s'attendait pas." Let the watchword be: "J'appelle un chat un chat, et Rollin un fripon!" Men of education will understand that all over the world.—I am, &c.,

A. TOLHAUSEN.

London, March 22, 1859.

LOCAL ASSESSMENTS BILL.

SIR,—Will you allow me space in your next number to inform the Societies interested in maintaining their present exemption from local rates, that the gentlemen who met at Fendall's Hotel to-day, have had an interview with the Home Secretary, Mr. Estcourt, M.P., and he has promised to give a favourable consideration to the amendment of which Mr. Wyld, M.P., has given notice, and the object of which is to omit from the Bill so much as repeals the Societies Exemption Act, 6 & 7 Vict., c. 36.

The Committee on the Bill will be postponed for a fortnight; it will be important to our success that, in the meantime, every Society which has not already done so, should petition for this amendment; and also that every Society should write to the Members of Parliament for its district, urging them to attend the House when the Bill goes into Committee, and support Mr. Wyld's amendment.—I am, &c.,

ARTHUR RYLAND.

March 23, 1859.

MEETINGS FOR THE ENSUING WEEK.

MON. ......London Inst., 7. Mr. John Ella, "On Chamber, Orchestral, and Ballet Music."
Actuaries, 7.
Medical, 8.
Geographical, 8½. 1. Mr. Lawrence Oliphant, "Notes of a Voyage up the Yang-tse-Keang, from Wosung to Stankow." 2. Sir John Davis, Bart., "View of the Great Valley of the Yang-tse-Keang, before and after its occupation by the Chinese Rebels." 3. Ascent of the Yang-tse-Keang, by Lieut. W. Blackney, R.N., dated Shanghai, Jan. 22, 1859. Communicated by Capt. B. Drury.

TUES. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. Discussion on Mr. Jackson's Paper, "Description of the Melbourne Gravitation Water Works," and, if time permits, M. de Brussant, "On a New System of Axle Boxes and Journals for Machinery without Oil." 2. Mr. McMaster, "On the Permanent Way of the Madras Railway."

WED. ......London Inst., 3. Mr. E. W. Brayley, "On Meteorology."
Society of Arts, 8. Mr. S. Alfred Varley, "On the Practical Bearing of the Theory of Electricity in Submarine Telegraphy, the Electrical Difficulties in Long Circuits, and the Conditions requisite in a Cable to insure Rapid and Certain Communication."
Microscopical, 8.
Chemical, 8. Anniversary.

THURS. ...Royal Inst., 3. Prof. Tyndall, "On the Gravity of Liquids."
London Inst., 7. Professor Bentley, "On Vegetable Substances used for the food of man."
Antiquaries, 8.
Royal, 8½.

FRI..........United Service Inst., 3. Capt. Tyler, "On the Rifle and the Spade, or the Future of Field Operations."
Archæological Inst., 4.
Royal Inst., Meeting, 8. Lecture 9. Mr. N. S. Maskelyne, "On the Optical Relations of the Crystal Molecule as Revealed by Polarised Light."

SAT. ......London Inst., 3. Mr. E. M. Brayley, "On Meteorology."
Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."

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* Well says Guizot, in his Histoire de la Civilisation:—"Telle est d'ailleurs la noble nature de l'humanité qu'elle ne saurait voir un grand développement de force matérielle sans aspirer à la force morale qui doit s'y joindre et la dominer; quelque chose de subalterne demeure empreint dans le bien-être social tant qu'il n'a pas porté d'autres fruits que le bien-être même, tant qu'il n'a pas élevé l'esprit de l'homme au niveau de sa condition."

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 18, 1859.]

Dated 16*th November*, 1858.

2576. W. B. Johnson and J. Shepherd, Manchester—Imp. in machinery or apparatus for adjusting the permanent way of railways.

Dated 19*th January*, 1859.

168. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in apparatus for making cigarettes. (A com.)

Dated 24*th January*, 1859.

222. H. Owen, Portswood, Southampton—Imp. in stockings.

Dated 10*th February*, 1859.

378. G. L. Stocks, Bridge-road, Poplar—Imp. in steering apparatuses.

Dated 17*th February*, 1859.

448. C. Fay, Manchester—Imp. in apparatus for working railway breaks.

Dated 24*th February*, 1859.

502. J. Holms, Glasgow—Imp. in machinery or apparatus for propelling vessels, ships, and boats.

Dated 25*th February*, 1859.

512. C. W. Siemens, John-street, Adelphi—Imp. in electric telegraphic line wires. (Partly a com.)

Dated 2*nd March*, 1859.

548. J, Valda, London—Imp. in studs and other like fastenings for dresses, belts, or other purposes.

550. R. H. Collyer, Alpha road, Middlesex—A process of preparing materials for the manufacture of paper, and a machine employed therein, which machine is applicable for crushing, grinding, bruising, and reducing various substances.

552. F. J. Jones, Aldermanbury—An imp. in buckles and clasps.

554. E. Roche, Marseille, France—Imp. in the manufacture of paper suitable for forming cigarettes and for other purposes, and also imps. in the manufacture of cigars.

556. W. E. Newton, 66, Chancery-lane—Imp. in the construction of barometers or instruments to indicate pressure. (A com.)

558. J. Kershaw, Allerton, near Bradford, Yorkshire—Imp. in means or apparatus employed in weaving.

560. H. Brown, Galashiels, Selkirk, Scotland—Imp. in machinery for cutting and finishing the surfaces of woollen and other fabrics.

Dated 3*rd March*, 1859.

562. H. Kohn, 5, North-place, Gray's-inn-road—Imp. in articles of wearing apparel called coats.

563. J. Harrison, Bermondsey, Southwark—An imp. or imps. in the construction of rotating window sashes.

564. T. Wilson, Birmingham—An imp. or imps. in breech-loading fire-arms.

565. A. W. Hale, New Britain, U.S.—A new and improved machine for cutting or mincing meat, vegetables, &c.

566. J. D. Dougall, Glasgow—Imp. in fire-arms.

567. W. Jackson, Colne, Lancashire—Imp. in shuttles for looms.

568. W. Score, 9, Osborne-terrace, Clapham-road—Imp. in the manufacture of soap.

571. T. Cook, Stowmarket, Suffolk—An apparatus for raising and lowering coffins and bodies, either for burial or disinterment.

Dated 4*th March*, 1859.

573. C. F. Dennet, Pall-mall—Imp. in bayonets.

574. M. Rider, Todmorden, Yorkshire—Imp. in, or applicable to, machines for preparing, spinning, and doubling cotton and other fibrous materials.

575. J. Cowban and E. Andrews, Burnley, Lancashire—Imp. in machinery or apparatus for spinning fibrous materials.

576. R. A. Brooman, 166, Fleet-street—An imp. in boiler stays. (A com.)

577. C. R. Mead, 176, Great Dover-street, Southwark—Imp. in water gas-meters.

Dated 5*th March*, 1859.

578. W. Bailes and J. Bailes, 434, Oxford-street—An improved ship's berth for prevention of sea sickness, composed of wood and metal.

579. J. M. Dunlop, Manchester—Imp. in machinery or apparatus for cleaning fibrous materials.

580. J. Leigh, Manchester—Imp. in the purification of coal gas.

581. J. Fraser, Banff, N.B.—Imp. in ploughs.

582. F. W. Parker, Sheffield—Imp. in sewing machines.

583. E. Vigers, Paddington—Imp. in the construction of ships and other vessels.

584. W. P. Savage, Roxham, Downham Market—An improved machine for excavating, raising, and depositing soil.

585. F. Verdeil, 30, Rue St. Sulpice, Paris, and E. Michel, 4, Quai Imperial, Puteaux, Seine—Imp. in treating madder.

586. G. Leach, Leeds—Improved machinery for reeling and leashing yarn or thread.

587. F. Morton, James-street, Liverpool—An imp. in the construction of strained fences.

Dated 6*th March*, 1859.

589. H. W. Patrick, 4, Mill Hill-terrace, Acton—An imp. or imps. in an apparatus for chemical and dental laboratories, or other manufacturing or experimental uses, which he proposes calling a "paragon laboratory forge."

590. D. Prondfoot, Glasgow—Imp. in Turkey-red dyeing.

591. A. Cabany, Anzin, Nord, France—A new system of quoins (wedges) for railways.

592. W. Palmer, Long Eaton, Derbyshire—An improved railway carriage break, and coupling apparatus connected therewith.

593. F. Ayckbourn, 27, Henry-street, Vauxhall-gardens—Laminating india-rubber cloths with paper sheets.

594. W. Gossage, Widnes, Lancashire—Imp. in the treatment of certain ores of copper for the extraction of metals therefrom.

595. J. Aspinall, Great Tower-street—Imp. in evaporating in vacuo.

596. P. E. Aimont, Paris—Imp. in the construction of waggons and other carriages for railways and ordinary roads, and of apparatuses connected therewith.

597. J. Orr, 31, South Albion-street, Glasgow—Imp. in weaving ornamental fabrics.

598. J. P. Clarke, King's-street Mills, Leicester—Imp. in the manufacture of reels for the winding on cotton, linen, thread, silk, or other fibrous materials.

599. J. L. Jullion and G, Pirie, Stoneywood Works, Aberdeen—The manufacture of gelatine.

Dated 8*th March*, 1859.

601. A. Booth, senr., and A. Booth, jun., Manchester—Imp. in machinery or apparatus for making or manufacturing tags for laces.

603. G. Twigg, Birmingham——An improved fusee-igniter for the use of smokers.

605. J. N. Ryder, Bexley Heath, Kent—Imp. in preserving fruits, and in apparatus used for such purposes.

607. W. Clark, 53, Chancery lane—Imp. in submarine telegraph cables. (A com.)

Invention with Complete Specification Filed.

628. N. Washburn, Massachusetts, U.S.—A new and useful or improved machine for rolling tires for wheels.—11th March, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, March* 18, 1859.]

March 18*th.*

2106. J. Luis.
2108. J. B. Beasley.
2110. H. W. Grylls.
2114. H. Firmin.
2119. L. de Pariente.
2124. A. M. Perkins.
2130. R. A. Brooman.
2146. H. H. Henson and W. F. Henson.
2150. G. L. Fuller.
2165. E. Thompson and W. Lazenby.
2172. G. T. Bousfield.
2210. M. Henry.
2246. E. Birchley.
2277. M. Sautter.
2298. W. E. Newton.
2553. M. L. J. Lavater.
2590. M. Caton.
2674. R. Bodmer.
3746. G. W. Bales.
2762. T. Bailey.
26. M. A. F. Mennons.
28. E. Balchin.
74. T. J. Claxton.
117. W. Wilson.
124. W. Craft and T. Wilson.
170. J. C. Reid and W. Milner.
188. J. Hick & W. Hargreaves.

[*From Gazette, March* 22, 1859.]

March 22*nd.*

2129. T. Howe.
2140. D. Grant.
4145. R. A. Brooman.
2181. A. Normand.
2197. H. G. Collins.
2205. F. Trevithick.
2221. C. Hill.
2279. H. Parker.
2387. B. Goodfellow.
2455. D. Fryer, T. Leach, C. Watt, and W. Holmes.
2995. S. S. Bateson.
127. R. Romaine.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, March* 18, 1859.]

March 14*th.*

630. H. Bessemer.
657. E. S. Stott.

March 15*th.*

790. F. Grice.

March 16*th.*

659. A. V. Newton.
711. W. Ball.
736. W. Ball.

[*From Gazette, March* 22, 1859.]

March 17*th.*

633. J. Mitchell.
642. T. Bird.

March 18*th.*

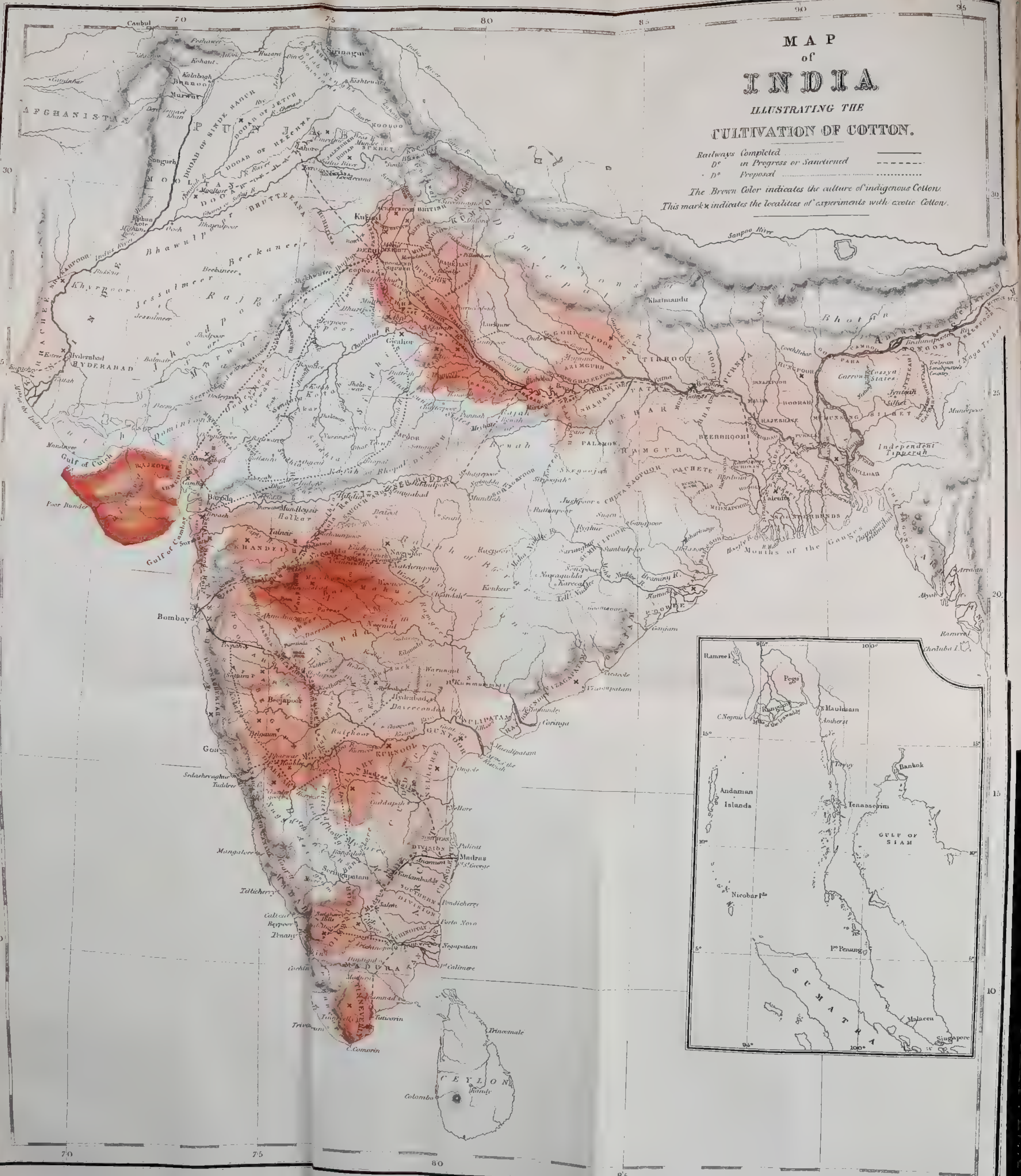
640. P. A. le Comte de Fontainemoreau.
670. W. Drummond.

March 19*th.*

666. J. W. Burton and G. Pye
682. G. G. A. L. M. Schelhorn.
707. J. D. Dunnicliff and S. Bates.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4152	February 28.	Air Tight Slide Cover	William Larke and Son	17, Little Moorfields, City, E.C.
4153	March 4.	arts of a Buckle	Oastler and Palmer	13, White's Grounds, Bermondsey.
4154	,, ,,	The Solar Hat Ventilation	Stephen William Silver & Co.	66, and 67, Cornhill, E.C., &c.
4155	,, 8.	hirt	Dawson and Macnicol	50, Buchanan-street, Glasgow.
4156	,, 9.	Spring Balance	George Salter and Co.	West Bromwich.



MAP
of
INDIA
ILLUSTRATING THE
CULTIVATION OF COTTON.

Engraved by J. & C. Walker

Journal of the Society of Arts.

FRIDAY, APRIL 1, 1859.

EXHIBITION OF 1861.

The following summary of information, bearing upon the Exhibition of 1861, has been drawn up by a correspondent :—

Institution of Decennial Exhibitions.

The progress of the Society of Arts, from the time of its foundation to the present, has been marked by a succession of Exhibitions, the nature, scale, and object of which have varied and extended, and gained importance and public support, as Arts, Manufactures, and Commerce have advanced and flourished, from the smallest beginnings, in 1754, to the last great success in 1851. The time has arrived when the Council of the Society should make another great effort to complete the work it has so far successfully accomplished. Having brought public opinion to admit that civilisation and commerce were stimulated by the great International Exhibition of 1851, it must now endeavour to satisfy it that the advantages gained to Arts, Manufactures, and Commerce by one great gathering of the world's industry will soon be lost, and that England will fail to maintain the high position—morally and commercially—which she gained, as having been the first to inaugurate International Exhibitions, unless she now follows up that movement, and declares that International Exhibitions must be held periodically, and that the period between them must not exceed ten years. If they be held periodically most will admit that they should recur within the working life of each generation, and however liberal the average of years at which that life is calculated, it seems clear that an interval of ten years must absorb so large a portion of it, that while a majority might reasonably calculate on seeing two Exhibitions, very few men could hope to make profitable use of a third.

These Exhibitions should not be looked at in an exclusive spirit, but be valued as the best means under Providence so thoroughly to mingle the feelings and wants—the happiness and prosperity— of all nations, that public opinion, safely resting on the broad basis of common interests, should be able to exercise a continually-increasing control over the Governments of the world. Although no one who carefully watches events can doubt that this unseen moral power does beneficially influence the course of public events, yet it has still much to do in checking, by its influence, that wasteful expenditure of life and property in national arrangements, which abstract so much from the industrial power and wealth of the world—injuring Commerce, depressing Art, and retarding Manufactures.

In seeking, then, the support of the public for the first of a Decennial series of International Exhibitions to be held in 1861, the Council of the Society, judging by their published resolutions, are satisfied they are only helping to carry on what was seriously begun in 1851—not as a mere copy or repetition of that Exhibition, but as a Collection of Works of Art and Manufactures to show the world's progress since that time.

The Society does not propose to compete with 1851; the first International Exhibition ever held, and the first of a series to be held every ten years must obviously be quite distinct from the other.

It is proposed that the works to be exhibited in 1861 shall be selected for their excellence; that they shall be arranged in *classes*, and not according to *countries;* that Music and Painting shall be included; and that foreigners shall be admitted to contribute on the same conditions as British exhibitors.

The Advantages of Exhibitions.

All experience shows that periodical Exhibitions present a steady improvement in the quality and design of articles exhibited. The *public* are benefited educationally, socially, and morally, by such displays; and that *manufacturers* derive a direct profit from them is proved by the constantly increasing number of exhibitors. This is the case with all National Exhibitions in Belgium, Italy, Austria, Spain, Prussia, Sweden, Bavaria, and Russia, and particularly in France, where such exhibitions originated.

The first French National Exhibition was opened in Paris, in 1798, by the Marquis d'Avèze, the originator of the idea. It remained open three days, and the articles displayed were of an aristocratic and costly, rather than of a popular, character. The exhibitors numbered only 110 and a jury of nine men was appointed to decide upon their merits.*

The experiment was so successful as to lead to the adoption of periodical Exhibitions.

The second Exhibition took place in 1801, when the exhibitors were more than doubled: they reached 229.

The third Exhibition took place in 1802, after the very short period of one year. The exhibitors had increased to 540, and their productions showed an extraordinary progress in every department. Mechanical science had facilitated manufacture, and reduced the prices of all articles in popular demand.

The fourth Exhibition opened, after a longer interval, in 1806, supported by the largely increased number of 1,422 exhibitors.

The fifth Exhibition took place in 1819, after an interval of thirteen years, and comprised the moderately increased number of 1,662. It displayed a great improvement in many branches of popular manufacture.

The sixth Exhibition, in 1823, showed a slight decrease in the number of exhibitors, who, from 1,662, had fallen to 1,648. On the other hand, the jury rewards were increased from 809 to 1,091.

The seventh Exhibition, in 1827, had 1,795 exhibitors. Steam-power in manufacture began to be felt; goods had improved; prices had diminished; and the foundation was laid of a large export trade.

The eighth Exhibition was in 1834; a steady progress was shown in every industrial department, and the exhibitors had increased to 2,447.

The ninth Exhibition, in 1839, had 3,281 exhibitors, and was remarkable for its display of raw produce, and a purer taste of design.

The tenth Exhibition, in 1844, was supported by 3,960 exhibitors, of whom no less than 3,253 were honourably recognised by the jury.

The eleventh Exhibition, in 1849, comprised 4,494 exhibitors. Its great and predominating attraction was machinery.

English Exhibitions.

The above being the last Industrial Exhibition in France, previous to our Great Exhibition of 1851, we may now pass to the annual exhibitions of the Royal Agricultural Society of England, which show the same law of progress. They have held twenty exhibitions in different towns, from 1839 to 1858 inclusive. Starting from Oxford, twenty years ago, with nothing but a record of 350 head of cattle exhibited, they reached last year (1858), at Chester, a town contribution of £1,800, a list of receipts for admission amounting to £6,187, a list of exhibitors of agricultural implements reaching

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* Report of M. Digby Wyatt, Esq., on the French Expositions. Sept. 1849.

197, another list of stock exhibitors reaching 402, with 1,444 head of cattle, and visitors amounting to 63,866.*

These shows of agricultural implements by the Royal Agricultural Society have led to such improvements in their design and manufacture as to have created a large and important export trade, prominently figuring in our export returns. The Council of the Royal Agricultural Society, on the motion of Mr. Brandreth Gibbs, the Hon. Superintendent of the arrangements for the Exhibitions, and therefore most intimately acquainted with the feelings of exhibitors, have decided on holding in 1861, if a site can be found, a Great Exhibition of Cattle and Implements in London, a proof that the Exhibition of Implements in Hyde Park, in 1851, was satisfactory to exhibitors and useful to agriculture.

In Horticultural Exhibitions a progress even more rapid has been shown. Not only have they led to improvements in the culture of native, and the naturalization of foreign plants, but they have taken botany out of its abstract existence in books and pictures, and have placed it practically before the eyes of the public, to aid in a useful, beautiful, and, what is gradually becoming a necessary part of education. The annual displays at Chiswick have been the creators of the Botanic Gardens, in the Regent's Park, as well as the displays of flowers which are among the most interesting and popular attractions of the Crystal Palace at Sydenham.

Their beneficial influence may be traced in many local displays and in many private plantations throughout the country.

The Exhibitions of Painting show a great amount of progress, as is evidenced by the National Gallery, the Royal Academy, and the Old and New Water Colour Societies.

Exhibitions of the Society of Arts.

Passing in review the history of Industrial Exhibitions in this country, the first that comes under notice is one held in 1829, under the patronage of King George IV., called "A National Repository for the Exhibition of specimens of new and improved Productions of the Artisans and Manufacturers of the United Kingdom," and which took place in the Royal Mews, Charing-cross. This, though under the management of a committee of distinguished men, with the Hon. G. Agar Ellis for its Chairman, was not sufficiently successful to warrant its being repeated. The idea of forming in England periodical exhibitions of the products of industry, in connection with the Society for the Encouragement of Arts and Manufactures, was conceived in 1845, when a committee of the Council of the Society of Arts was appointed to make the necessary inquiries as to the willingness of manufacturers to contribute their productions to such an Exhibition, and a fund was subscribed for the purpose of meeting the preliminary expenses, but owing to the want of sympathy on the part of the manufacturers the project was not then proceeded with.

*Date.	Place	Town Contribution.	Amount paid for Admission.			No. of Implement Exhibitors.	No. of Stock Exhibitors.	No. of Head of Cattle Exhibited.
		£	£	s.	d.			
1839	Oxford	...	...			...	...	350
1840	Cambridge	...	...			...	...	451
1841	Liverpool	...	...			...	...	463
1842	Bristol	...	...			84	...	497
1843	Derby	...	...			113	...	608
1844	Southampton ...	1000	2432	3	2	99	...	716
1845	Shrewsbury ...	1000	1682	19	5	93	...	627
1846	Newcastle	1000	2168	15	11	110	...	775
1847	Northampton ...	1200	2473	11	0	142	...	580
1848	York	1000	2514	12	0	145	...	866
1849	Norwich	1000	2360	15	10	145	...	799
1850	Exeter	1250	2493	19	4	118	...	769
1851	Windsor	600	3397	4	9	‡	...	1226
1852	Lewes	1500	1184	10	4	105	217	828
1853	Gloucester	1500	2734	0	11	128	355	931
1854	Lincoln	1500	3378	6	5	130	331	939
1855	Carlisle	1400	3260	13	10	121	280	1076
1856	Chelmsford... ...	1200	2988	8	5	151	318	906
1857	Salisbury	1500	3447	15	9	156	356	1462
1858	Chester	1800	6187	5	5	197	402	1444

‡ Implements in 1851 were exhibited in London at the Crystal Palace.

The average number of visitors at the several country meetings, up to the Chelmsford meeting, was found to be about 35,000, but at Salisbury the actual number was 36,023, while at Chester it amounted to no less than 63,866.

The English people were then very imperfectly acquainted with the value of such Exhibitions and their influence upon the character as well as the commerce of the nation. They required to be educated for this object, and education had to be provided. Premiums for Works of Industrial Art and Exhibitions, on a comparatively small scale, were accordingly instituted by the Society of Arts for this purpose; and thus arose the Society's series of special premiums for specimens of British Arts and Manufactures, which, with the annual exhibitions of them, have formed so important an element in the progress of public knowledge and the formation of public taste.

So little advanced, however, was public information, that in 1846 hardly any competitors came forward, and it was with difficulty the judges could find subjects worthy of reward.

The first Exhibition of any magnitude—stimulated by His Royal Highness Prince Albert, the President of the Society of Arts—took place in the House of the Society in March, 1847. It would have been a total failure but for two individuals, who made it a point of personal favour, with a few great manufacturers, to be permitted to select from their stores a sufficient number of articles to make a show. The result was highly satisfactory. 20,000 people visited the Exhibition; and next year, in 1848, the exhibition on the part of manufacturers was spontaneous, and upwards of 70,000 persons visited the Society's rooms. The next Exhibition, in 1849, was still more successful; the visitors were more numerous, the articles sent in were of a superior quality, and the public taste was better educated to appreciate their excellence.

First International Exhibition.

It was obvious, during the progress of the foregoing Exhibitions, that the public mind was gradually becoming better informed on the nature and effects of great Public Exhibitions of Industry; and at the end of the Session, in June, 1849, everything seemed ripe for carrying into effect the plan of a Great Exhibition. On the 30th of June His Royal Highness stated the four great Divisions—of *Raw Material—Machinery and Mechanical Inventions—Manufactures—Sculpture, and Plastic Art*, of which he proposed the Exhibition should consist, and announced its distinguishing character of universality, as a collection of the Industry of all Nations.

At this period so little was known of the general feeling of manufacturers and agriculturists towards such displays in this country, that less than two years before the opening of the Great Exhibition, a commission was appointed to visit the principal towns in England, Ireland, and Scotland, and collect opinions from the leading men.* The result was most satisfactory. On the point of the *general expediency of such periodical exhibitions*, they met with the most perfect unanimity in all parts of the country, and expressions of surprise, if not regret, that our country should have been so tardy in instituting such an Exhibition. It was considered that the benefits of the Exhibition would be great, individually and nationally; that great good had been done on the continent by such exhibitions; and that the larger the competition the better would it be for all. A willingness to exhibit was found to be very general; and, on the point of *whether prizes should be awarded*, although it was considered that the best prize was commercial success, it was admitted that the stimulus of worthy prizes would be beneficial, if a thoroughly impartial distribution could be secured.

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* Report of Henry Cole and Francis Fuller, Esqrs., the Commissioners appointed. London, October, 1849.

On the important point of *whether such Exhibitions should be supported by a national grant, or by voluntary subscriptions*, the preponderance of opinions was *wholly* in favour of the voluntary principle, and it was generally considered that if the financial aid of goverment had been sought, the public would have felt themselves relieved, in a great measure, from the necessity of assisting.

Fifty towns were visited after this, and meetings were held, at all of which favourable resolutions were passed; and by January, 1850, the names of 60,000 influential persons had been obtained as supporters of the great plan.

About this date, on the application of the Society of Arts, the Royal Commission was appointed; the burden of the guarantee fund was thrown upon the voluntary contributors; and, in May, 1851, the building was successfully opened, under the energetic exertions and able organisation of the Executive Committee.

It remained open about five months and a-half; its foreign exhibitors numbered 6,556, and the exhibitors of the United Kingdom and dependencies 7,381, forming a grand total of 13,937. The estimated value of the articles exhibited (excluding the Koh-i-noor diamond) was:—

	£	s.	d.
United Kingdom	1,031,607	4	9
Dependencies of ditto.	79,901	15	0
Foreign countries	670,420	11	7
Total	£1,781,929	11	4

The number of prize medals awarded was 2,918, and of Council medals, 170. The daily admissions by payment reached 5,265,429, and the season tickets, 773,766; together, 6,039,195; the gross receipts were respectively £356,278 and £67,514; together, £423,792; and the nett profit was about £200,000, at present invested by Her Majesty's Commissioners, in land at South Kensington.[*]

PROSPECTS OF 1861.

Large as these results may appear, they show a comparatively small success if we look at the number of visits compared with the amount of local population.[†] The population of the metropolis in 1851 was 2,300,000, and this gives little more than two-and-a-half visits to each individual. The twelfth Exhibition at Paris, in 1855, shows an increase upon this, as, with a population of 1,200,000, the receipts reached £128,099, and the visitors 4,593,576, which gives three-and-three-quarters visits to each individual. The exhibitors, although showing a decrease upon those of 1851, in London, showed a marked increase upon those of the eleventh French Exposition, 1849. Their numbers were 9,790, without Algeria, as against 4,494; an increase greatly attributable to the admission, after our plan, of international exhibitors.

At the Dublin Exhibition, the daily admissions reached 634,523; the season ticket admission, 366,745; and the receipts respectively, £28,981 and £18,382. With the local population of 254,000, this gives nearly four visits to each individual.

At the Manchester Exhibition, the daily admissions reached 1,053,538; the season ticket admissions, 283,177; and the receipts respectively, £60,506 and £23,014. With the local population of 340,000, this gives nearly four visits to each individual.

Thus it will be seen that the visits, in proportion to population, at Manchester, Dublin, and Paris, considerably exceeded those of London in 1851. The two places where they showed a decrease were Cork and Birmingham.

At the Cork Exhibition, the daily admissions reached 74,095; the season ticket admissions, 54,936; and the receipts respectively, £2,874 and £1,545. With the local population of 86,000, this gives a little over one visit to each individual.

At the Birmingham Exhibition, held previously to the Exhibition of 1857, the visitors reached 80,882; and the receipts, £3,632. With a local population of 173,000, this gives rather less than one-half visit to each individual.

The New York Exhibition is left out of these calculations, as it was an entirely private enterprise, of the results of which the Society of Arts possesses no statistics.

If the numbers paying one shilling and under are separated from the higher rates, the following results appear:—In London, they were nearly two to one of the population; in Paris, just over three and a-half; in Dublin, just under two-and a-quarter; in Cork, about three-quarters; in Birmingham, just under a-half; and in Manchester, nearly two-and-three-quarters; all to one of population.

The lowest rate of admission in Paris was 4 sous, which produced £17,459 out of £128,000 sterling; at Dublin, sixpence, which produced £3,331 out of £29,000; at Cork, sixpence, which produced £1,200 out of £2,894; and at Birmingham, sixpence, which produced £691 out of £3,632. The one shilling admissions in London—the lowest rate—produced upwards of six-tenths of the whole receipts.

Leaving the facts of the past for the calculations of the future, we come upon the estimated increase of population in 1861.[†] This will be over half a million; or 2,885,800, as against 2,362,236 in 1851. This number is almost equally divided into males and females.

Next follows the change that will have taken place in the population during the space of ten years.[‡] Taking the males at 1,442,900, one quarter of this number will consist, in 1861, of persons who were too young to benefit by the Exhibition of 1851, and one half will consist of persons between the ages of 15 and 50, capable of appreciating the New Exhibition. With regard to the female half of the population, their attendance as visitors is calculated to outnumber that of the males.

The number of visitors, however, must not altogether depend upon the population, but upon the facilities offered for conveying that population to the Exhibition.[§]

The following table, compiled from certain materials in Captain Galton's reports to the Board of Trade, will show that there has been a steady increase in railway traffic in England from 1849 to the present time.

	Separate Journeys in Round Numbs.	Increase.	Miles open.	Increase.	Journeys per mile.	Increase.
1849	64,000,000		5,579		11,442	
1850	73,000,000	9,000,000	6,326	747	11,515	73
1851	**85,000,000**	**12,000,000**	**6,755**	**429**	**12,640**	**1,125**
1852	89,000,000	4,000,000	7,113	358	12,531	*
1853	102,000,000	13,000,000	7,488	375	13,659	1,128
1854	111,000,000	9,000,000	7,846	358	14,160	501
1855	119,000,000	8,000,000	8,177	331	14,503	343
1856	129,000,000	10,000,000	8,502	325	15,213	710
1857	139,000,000	10,000,000	8,901	399	15,617	404
ASSUMED.						
1858	148,500,000	9,500,000	9,251	350	16,017	400
1859	158,000,000	9,500,000	9,601	350	16,417	400
1860	167,500,000	9,500,000	9,951	350	16,817	400
1861	**177,000,000**	**9,500,000**	**10,300**	**350**	**17,217**	**400**

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[*] Report of Commissioners for the Exhibition of 1851.

[†] Letter of William Hawes, Esq., to the Chairman of Council of the Society of Arts. London, Feb. 16th, 1859.—See *Journal*, vol. vii., p. 207.

[*] Decrease 109.

[†] Letter of Registrar-General to the Chairman of the Council of the Society of Arts. London, Feb. 16th, 1859.—See *Journal*, vol. vii., p. 223.

[‡] Letter of Charles M. Willich, Esq., to the Chairman of the Council of the Society of Arts. London, Feb. 18th, 1859.—See *Journal*, vol. vii., p. 223.

[§] Letter of Colonel Owen to the Chairman of the Council of the Society of Arts. London, March, 1859.—See *Journal*, vol. vii., p. 243.

Had the increase of 9½ millions of railway journeys a-year been uniform, the number of journeys per mile in 1851 would have been only 12,132, giving an increase of 468. If this be multiplied by 6,755, the number of miles open that year, it will give us 3,161,340 journeys as the increase of travelling due to the Exhibition. Some of these additional journeys may have been due to other causes, but a large proportion of the travellers, on the other hand, must have paid more than one visit to the Exhibition, and there is, therefore, fair reason to assume that one and a half out of the six million visits to the building were from persons induced to come to London by the Exhibition; and the increase in the number of travellers was nearly four per cent.

Assuming the figures in the table to be tolerably correct, there will be 10,300 miles of railway open in 1861, with 17,000 travellers, in round numbers, to each mile. An increase of four per cent on this would be 680 per mile, instead of 468, or seven millions in 1861, against three millions in 1851.

It is, however, absurd to suppose that the country visitors to the Exhibition were only those who came to London on purpose. A large, and perhaps a larger proportion, must have consisted of persons who come daily to their business in London from the vicinity, or whom other pursuits may have called to London, and it is but a very moderate supposition that another 4 per cent. of the railway journeys of the year 1851 represented the ordinary travellers from the country who visited the Exhibition.

Thus there would be, supposing the attraction equal in 1861, 14 millions of railway journeys by visitors to the Exhibition against six millions in 1851, and, therefore, allowing two journeys, one up and one down, to each visitor, seven millions of country visitors instead of three millions, and the Exhibition of 1861 may afford to be less than half as attractive to command an equal numerical and pecuniary support from the country.

Assuming the remainder of the visitors of 1851 to be Londoners, and that they increased in 1861 in proportion to the increased population of London, there would be four millions instead of three for London, and seven millions instead of three for the country, which gives good ground for supposing that if the Exhibition of 1851 had taken place in 1861, it would have received eleven million visits instead of six millions.

These calculations apply exclusively to English railways.

The general system of railway management is much improved since 1851.* The continental managers have now learned to appreciate through booking, return tickets, and excursion traffic at reduced rates, which they would not look at a few years back. Many Continental lines have been opened since the year of the Great Exhibition, all more or less converging towards this country, and several others of great importance in shortening existing routes, and putting us in communication with new districts, will be completed during 1859 and 1860. The steam passages between America and Europe will be quadrupled in the present year (1859), and the fares lowered at least 30 per cent. The chain of railways now joining New York, Boston, Portland and Quebec, has been tripled since 1851; the distance between London and India has been decreased 25 per cent., and between England and Australia 50 per cent.; the time taken for passages to and from our West Indian colonies has been diminished one-third, and we have a well-organised steam communication with South America and Africa, which did not exist in 1851.

I have now gone briefly over the principal points in the past history of Industrial Exhibitions, and arranged a few carefully collected data as guides to the future.

I have shown that all such exhibitions are progressive; that nothing can blot them out; that they flourish under every form of government—a Directorate, a Consulate, an Empire, a Monarchy, or a Republic.

I have stated what was done in this country in the space of two years, before the organisation of such exhibitions had become, in some measure, a defined science, and I infer from this that the second exposition may be collected at a less proportionate cost than the first.

The Exhibition of 1851 was intended for a periodical Exhibition. The word "periodical" was used in every deputation to manufacturers or persons interested; and in almost every document issued by the Committees. The period fixed upon at that time (1849) by the Society of Arts was that of five years, and this was stated in the first application for a Royal Commission.

The proposition was based upon the fact that intervals of five years had been found sufficient in France between the different reviews of the country's industrial development. If any doubt could then have been entertained that these intervals were too short for England, the same objection cannot now apply to periods of double that length. The facts and calculations I have been enabled to gather of the great and general progress during the last ten years, are conclusive proofs that the decennial period is the extreme division to be accepted.

The Society was strongly of opinion that any beneficial results which the Exhibition of 1851 might accomplish could only be fully known when the condition of general industry should be again tested by a similar Exhibition; and that, if none such should be held, the good effects of the Exhibition of 1851 would subside and evil would ensue, the stamp of authority having been so fixed by the jurors of 1851 on many articles of production as even to create an obstacle to further improvements. Present experience has shown this to be the case. Many houses have made large fortunes upon the reputation deservedly obtained in 1851, though they may not be able to keep their ground at a future Exhibition. These firms will at first give a cold support to a project that presents a fair field for competition and distinction to every young and intelligent manufacturer; but when all the inevitable preliminary difficulties are cleared away, and the time comes for the preparation of goods for display, it will be a necessity of their commercial existence that they should no longer hold back.

The class of enterprising manufacturers and their power of production will be increased, thereby affording the prospect of a better display to the visitors; while the class of visitors and their power of consumption will also be increased, thereby affording the hope of a better reward to the manufacturer.

Periodical reviews of the state of Art, Manufactures, and Commerce are not only of advantage to the trading classes, as a great and profitable medium for advertisement, but are a means of preventing that decay of certain branches of industry—(as the china trade of Derby, and the carpet trade of Axminster)—which is, to some extent, a national disgrace. Upon the educational effects of all such exhibitions we need hardly dwell. The improvements in decorative art and in popular illustrated literature, since 1851, are proofs of a general advance in taste, that may be attributed, in some degree, to the influence of the last great display. Such exhibitions, by creating a demand for excellence, rather than for quantity, also improve the position of the skilled workman, and increase his reward at the same time that they teach him to regard his labour as an art.

Of the details of the proposed Exhibition it is of course premature, at present, to speak. Much will depend upon the selection of the site, and no spot, having due regard to the means of cheap and easy access, with railways about to come almost to the very spot, seems more eligible for the purpose than the large number of acres of dry, gravelly soil that is held by the Commissioners of 1851 at South Kensington. It possesses the advantages of being ready for instant occupation; in the hands of trustees who derived it from the proceeds of the former Exhibition, and of being in a tolerably central position, if London is taken in connection with its outlying districts. It is on the border of a main line of road, leading from east to west, which is well supplied with cheap numerous conveyances. It is also favourably situated for that large class of visitors, who will be compelled to walk, and whose requirements must be specially looked to in all undertakings of this kind that wish for anything like success. The place has other features to recommend it. The Museum of Science and Art is already established there, and if the Horticultural Society of London should succeed, as they desire, in carrying their annual botanical displays to this ground, there will then be a centralisation of Exhibitions such as it is most desirable for the country to see.

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* Letter of Sir Cusack P. Roney to the Chairman of the Council of the Society of Arts. London: Feb. 16, 1859. See *Journal*, vol. vii., p. 191.

To give proper confidence to guarantors and exhibitors, the undertaking should have a national character, and be carried on under the countenance, if not under the immediate direction of a properly constituted authority.

The Council of the Society of Arts have received numerous offers of support, upon a much more popular and extended basis than on the last occasion, sufficient to enable them to undertake with confidence the task of finding four-fifths of what they consider the necessary guarantee. If her Majesty's Commissioners of 1851 will sign for £50,000 out of £250,000, and allow it to be announced that, provided this guarantee is completed by a given day, they will hold the Exhibition of 1861 on their own ground at South Kensington, the Council of the Society of Arts should be prepared to take upon itself the labour and responsibility of completing the necessary sum.

With railway facilities increased fifty per cent., with a population not only much changed and much advanced, but increased twenty per cent., and with the consequent increase of capital to that extent, there cannot be any doubt that, with a little timely energy and co-operation, the proposed Exhibition of 1861 will become a great and splendid success.

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th inst.

Persons intending to be Exhibitors should communicate with the Secretary of the Society of Arts as soon as possible, stating :—

1st. The Title of the Invention.

2nd. Whether the Article will be a Model, Drawing, or Specimen.

The Articles must be forwarded to the Society's house, carriage paid. The days fixed for receiving them are Thursday the 7th, Friday the 8th, and Saturday the 9th inst. No articles will be received after the last of these days.

Articles which have been included in previous Exhibitions of the Society of Arts cannot be re-admitted.

Articles should be accompanied by a short but clear description of the Invention, with a wood block (when possible) for illustration, and a reference to any publication in which the Invention is described.

All Drawings exhibited must be framed.

No charge is made for space, and the admission to the Exhibition is free.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

EXAMINATION PRIZE FUND FOR 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
— Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement :—

For Ashbourn Literary Institute.

Mr. J. Bamford, Solicitor.
Mr. J. Bowman, B.A., Grammar Schoolmaster.
Mr. T. Coleman, Solicitor.
Rev. W. A. Duckworth.
Mr. Green, Certificated Schoolmaster.
Captain Holland.
Mr. Marshall, Certificated Schoolmaster.
Mr. J. Walker, Grammar School, *Secretary.*

For Paisley.

Mr. Wm. Brunton, LL.D.
Mr. Thomas Coats, Ferguslie.
Rev. William Frazer.
Mr. Thomas Glen, Hillhead.
Mr. Peter Kerr, Whitehaugh.
Mr. Jas. J. Lamb.
Mr. Wm. Mackean.
Mr. D. Murray.
Mr. A. R. Pollock, Greenhill.
Mr. Louis Pujet.
Mr. James Reid.
Herr Rheban.
Mr. J. Smart.
Rev. Andrew Wilson.
Mr. Robert Wilson.
Thomas Macrobert, } *Secretaries.*
M. B. M'Kinlay, M.D. }

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

SEVENTEENTH ORDINARY MEETING.

Wednesday, March 30, 1859.

The Seventeenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 30th inst., W. Fothergill Cooke, Esq., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Canterbury, the Very Rev. the Dean of
Keysell, Richard
Pollard, George
Vallance, Henry

The following Institutions have been taken into Union since the last announcement :—

Lincoln, Newland Young Men's Mutual Improvement Society.
London, Young Men's Christian Association, Aldersgate-street.

The Paper read was—

ON THE PRACTICAL BEARING OF THE THEORY OF ELECTRICITY IN SUBMARINE TELEGRAPHY, THE ELECTRICAL DIFFICULTIES IN LONG CIRCUITS, AND THE CONDITIONS REQUISITE IN A CABLE TO INSURE RAPID AND CERTAIN COMMUNICATION.

By S. Alfred Varley, Assoc. Inst. C.E.

Since the practical realization of the electric telegraph, several valuable communications connected with the subject have from time to time been laid before this Society.

These papers have generally treated of the mechanical details and improvements in the apparatus which have been designed and brought forward by various patentees and inventors.

In the course of the discussions which have taken place it has appeared to me that the principles of the science of electricity have not always been sufficiently appreciated, and the practical value of many of the beautiful contrivances not elicited, from not having determined clearly the principles of the science which are involved in telegraphing, and, consequently, the properties which are essential, and must be possessed by all apparatus, to give them a practical value.

This feeling has led me to think that a paper on the Theory of Electricity, keeping always in view its bearing on electric telegraphy, and which should rather treat of the principles of telegraphic apparatus than confine itself to special contrivances, would be subservient to the progress of the object we have in view; for it must not be forgotten that although the world is always indebted to the practical man for the application of science to commercial purposes, and, in the case of the electric telegraph, it is even questionable whether we are not indebted for its very rapid extension in part to the inability of the projectors to appreciate difficulties which the philosopher foreseeing would have hesitated at—or, perhaps, to the greater faith possessed by the practical man in the ability of science to overcome whatever difficulties may present themselves; yet it must not be forgotten that, in the principles of a science, the philosopher is often far ahead of the practical man, and the latter at times comes suddenly and unprepared upon difficulties, which, had he understood correctly the principles long before developed by science, he would have been led to expect as natural consequences. As an example of this, I would mention the case of electric induction, which manifested itself so strikingly when the system of subterranean circuits was considerably extended on the introduction and successful manipulation of gutta percha.

This phenomenon was unexpected and unlooked for by many, though not all, of our practical electricians; and we find it referred to, and regarded at the present time, as a new fact which the electric telegraph has brought to light, and not one to have been anticipated; yet the laws of induction were beautifully and clearly developed by Dr. Faraday, as far back as 1838; and, when called upon to examine this new telegraphic difficulty, we find him alluding to it in an instructive lecture, delivered before the members of the Royal Institution, as a strong confirmation of the truthfulness of views he had put forth as far back as 1838. I would direct attention particularly to this, because I cannot help feeling that our progress is too often obtained by a laborious perseverance in almost empyrical experiments, until, by the laws of chance, a successful result is hit upon, instead of endeavouring, in the first place, to develop a guiding principle, and referring back to it, as each step forward is made, to test both the truth of the principles laid down and the correctness of the conclusions arrived at. Were this done, experience would not be paid for so dearly; and the commercial application of a science would not be almost paralyzed, as it sometimes is on its first introduction, by the costly series of experiments which have to be gone through before correct principles of working are established.

During March, 1858, the subject of telegraphic cables was very fully entered into by the Institution of Civil Engineers. Finding at that time that there were no papers on the electrical portion before the Institution, and feeling that the subject could not be fully considered without the electrical part being entertained, I was induced at the eleventh hour to attempt to supply the deficiency. Some explanation is perhaps therefore due from me for bringing forward, so shortly afterwards, another paper on almost the same subject. Owing to the large number of evenings which had already been occupied in the consideration of the mechanical portion of the problem, and the late hour at which my paper was submitted, it was only read in abstract, and no discussion taken upon it. The views, too, I then brought forward were opposed to some which have lately been laid very prominently before the public, and no opportunity given to contradict them, or to verify their correctness; and as I am convinced that so far from the subject being exhausted its importance is only now beginning to be appreciated, the opportunity having been offered to me to bring the matter before the Society of Arts I determined to avail myself of it.

The complete way in which the subject was taken up by the Institution of Civil Engineers is, however, I am glad to say, already bearing fruit; and since the publication of the papers by the Institution, several valuable discussions have taken place in the scientific journals, and in some of the remarks I have to lay before you to-night, I find, to a certain extent, I have been anticipated.

The generally recognised theory of electricity, as I understand it, supposes all bodies in their normal condition to have two powers or forces resident in them directly opposite in their character, being exactly balanced; in bodies in their natural state these forces are completely neutralized and rendered inactive, producing the ordinary condition of matter.

To these powers the name of electricities has been given, and although we are still as ignorant at the present day as the ancients themselves with regard to what electricity actually is, yet the fact of the existence of the electric telegraph is a proof of the progress which has been made in a knowledge of the laws, at least, which govern electric phenomena.

In the year 1838, Dr. Faraday clearly developed the principles of induction and conduction, since which time no further progress has been made in the fundamental truths of the science, though much has been done to confirm their correctness and to develop their consequences.

In the Philosophical Transactions for 1838, will be found Dr. Faraday's views on the subject of induction and conduction; and these, to my mind, so clearly explain all electric phenomena, that it will be as well at once to refer to them before proceeding further. After giving reasons for his belief in the identity of induction and conduction, he says, "all these considerations impress my mind strongly with the conviction that insulation and ordinary conduction cannot be properly separated when we are examining into their nature, that is, into the general law or laws under which their phenomena are produced. They appear to me to consist in an action of contiguous particles dependent on the forces developed in electrical excitement; these forces bring the particles into a state of tension or polarity, which constitutes both induction and insulation, and, being in this state, the continuous particles have a power or capability of communicating their forces one to the other, by which they are lowered, and discharge occurs. Every body appears to discharge, but the possession of this capability in a greater or smaller degree in different bodies, makes them better or worse conductors, worse or better insulators, and both induction and conduction appear to be the same in their principle and action, except that in the latter an effect common to both is raised to the highest degree; whereas in the former it occurs in the best cases in only an almost insensible quantity.

In part the 2nd of the Philosophical Transactions of the same date will be found a summary of Dr. Faraday's views, which I will also quote:—

"1st. The theory assumes that all the particles, whether of insulating or conducting matter, are, as wholes, conductors.

"2nd. That, not being polar in their normal state, they can become so by the influence of neighbouring charged particles, the polar state being developed at the instant, exactly as in an insulated conducting mass consisting of many particles.

"3rd. That the particles when polarised are in a forced state, and tend to return to their normal or natural condition.

"4th. That being, as wholes, conductors they can readily be charged either bodily or polarly.

"5th. That particles which, being contiguous, are in the line of inductive action, can communicate or transfer their polar forces one to another more or less readily.

"6th. That those doing so less readily require the polar forces to be raised to a higher degree before this transference or communication takes place.

"7th. That the ready communication of forces between contiguous particles constitutes conduction, and the difficult communication insulation; conductors and insulators being bodies whose particles naturally possess the property of communicating their forces easily, or with difficulty, and bodies having these differences as they have differences of any other natural property.

"8th. That ordinary induction is the effect resulting from the action of matter charged with excited or free electricity upon insulating matter, tending to produce in it an equal amount of the contrary state.

"9th. That it can do this only by polarising the particles contiguous to it, which perform the same office to the next, and these again to those beyond; and that thus the action is propagated from the excited body to the next conducting mass, and these render the contrary force evident in consequence of the effect of communication which supervenes in the conducting mass upon the polarisation of the particles of that body.

"10th. That, therefore, induction can only take place through insulators; that induction is insulation, it being the necessary state of the particles, and the mode in which the influence of electrical forces is transferred or transmitted across such insulating media."

To determine for myself the law which induction obeys, in conjunction with my brother, Mr. C. John Varley, I have tried some experiments.

The principle upon which these were based was that of the dual character of electricity, and the fact established by Dr. Faraday, that all statical charge is sustained solely and entirely by induction.

In bodies in their normal condition, the opposite forces or electricities being balanced and united, no attraction for neighbouring particles exists, but when these forces are separated, as in the case of a Leyden jar, the attraction which a given quantity of electricity exerts for the similar amount of negative on the opposite coating, will be less in proportion to some law as the thickness of the dielectric intervening is increased.

It was therefore assumed that the amount of free attraction under these circumstances, or more correctly the amount of induction which would be thrown upon neighbouring bodies, would increase inversely as the attraction between the opposite coatings diminished.

The apparatus made use of was constituted in the following way:—

A glass pillar, varnished, for better insulation, was mounted upon a board. On the top of this a brass plate was attached, and upon this plate the dielectric to be examined was laid. Over the dielectric another brass plate was then placed.

A Leyden arrangement was thus constructed, the upper and lower brass plates representing the inner and outer coatings of an ordinary Leyden jar.

A brass ball, suspended from a balance which had an adjusting arrangement, so that it could be raised or lowered, hung over the upper metal plate at a short distance from it.

The *modus operandi* was as follows:—

The upper brass plate was connected to the earth, and a series of sparks, through the medium of a sliding rod kept at a fixed distance from the prime conductors of a frictional machine, thrown into the lower brass plate of the Leyden arrangements, or the prime conductor was kept fully charged, and a carrier ball attached to a long glass rod was made use of to measure out definite quantities of electricity.

The room in which the experiments were performed, was heated with a stove, and the dryness of the atmosphere indicated by a hygrometer, so that the insulation might be as perfect as possible.

When a certain number of sparks had been thrown into the lower brass plate, the upper brass plate was disconnected from the earth, and the lower one attached to the balance, and if the tension of the charge was sufficient, the brass ball suspended from the balance was attracted down, and discharge ensued. The experiment was repeated again and again, and the number of sparks requisite to just attract the ball down, noted.

Glass plates were the dielectric employed, and the experiment was tried first with one plate, then with two, and then with three plates of glass between the upper and lower brass plates, the brass ball suspended from the balance being kept always at a certain fixed distance from the upper brass plate.

The results obtained from a numerous series of experiments were—that when two plates of glass were placed between the brass plates, only half the number of sparks which were required to raise the tension of charge sufficiently to cause discharge when one plate of glass separated the brass plates was requisite, and when three plates of glass divided the upper and lower brass plates, then a third of the number of sparks raised the charge to the same degree of tension, showing that through flat plates of glass, induction decreases in the inverse proportion to the thickness of the dielectric, that is to say, if the induction through one be 12, through 2 it will be 6, through 3—4, and so on.

In the case of a gutta percha covered wire, it was anticipated that as when the thickness of the gutta percha is increased, the outer surface increases at the same time, the decrease of induction consequent on the increased thickness of the insulating material would not be inversely proportionate to the depths of the gutta percha, but would follow some other law.

To put this to the test, a series of Leyden arrangements were constructed in the following way: three pieces of tube, of half an inch internal diameter, and 2 feet 6 inches long, were placed in the centre of tubes of 2 feet long, the internal diameters of which were 1 inch, 1½ inches, and 2 inches, and the space between the inner and outer tubes filled with melted resin. (Figs. 1, 2, 3.)

Fig. 1.

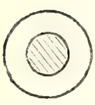


Fig. 2.

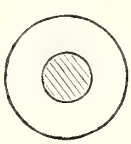
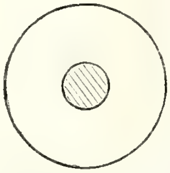


Fig. 3.



By this means three Leyden arrangements, with a uniform internal surface, but whose insulating material varied in thickness in the proportion of 1, 2, and 3 were constructed, and the same process as that already described with the flat plates was repeated.

The results obtained are shown in the annexed table.

Diameter of Inner Tube.	Thickness of Insulation.	Diameter of Outer Tube.	Inductive Force.
10	5	20	22
10	10	30	15·5
10	15	40	11·5

These results were very constant, but as resin was the only dielectric employed, the experiment requires repeating with other dielectrics, for there is reason to believe that with glass at least the decrease in induction consequent on an increased thickness of the dielectric would be somewhat greater than that indicated in the above table.

The reasons for this belief are the following:—When a galvanic battery is connected with the inner and outer coatings of a Leyden arrangement, induction will take place through the dielectric, and if the surfaces of the two coatings are equal, then the force will be equally divided over them; that is to say, if the battery force be 100, the tension of the charge on the one coating will be 50, and that on the other will be 50 also=100.

Let the surface of the outer coating be supposed to be infinite in extent, then the tension of the charge on the inner coating will approach infinitely near to 100, and the tension of the charge on the outer coating will be almost nil. An example of this we have when the earth represents one of the coatings of a Leyden arrangement; and this is the case in the prime conductor of a frictional machine, and also in the suspended wire of a telegraphic circuit; in these two examples the prime conductor of the machine and the wire of the telegraphic circuit represent the one coating, the air the dielectric, and the earth the other coating.

Now consider a case where the outer surface is double that of the inner one, the tension of the charge on the inner coating will then be double that of the *outer*; an example of this we have in the above table, where the inner surface is 10, the thickness of the insulation 5, which may here be regarded as unity, and the outer surface 20—the battery force being 100. Divide this into three parts, and we get 33⅓. Give two parts for the tension of the charge on the inner coating, and one part for the tension of the charge on the outer coating, then we shall have for the tension of the inner surface, 66⅔; for the outer surface, 33⅓=100 when united.

Now, consider the third example in the above table. Inner surface 10, thickness of insulation 15, outer surface 40, or quadruple that of the inner surface. In this case the tension of charge on the inner surface will be four times that of the charge on the outer surface. In other words, the tension of the charge on the smaller surface will be 80, and that of the outer surface 20, the united tensions equalling 100; but the thickness of the insulation is 15, or three times that of the first example; and it has been shown that induction decreases in the inverse proportion to the thickness of the insulating material; we shall therefore have to divide by 3, and and this will give 26·3 for the tension of the charge on the inner surface.

In the first example it has been shown that if the force be 100, the tension of the charge on the inner surface will be 66⅔, which, to avoid fractions, we may regard as 67. In the actual experiment the inductive force measured was 22; 67, therefore, represents 22, and as 67 is to 22 so should 26·6 be to the amount of force which would be expected to be obtained in the last example; this, when calculated by a simple Rule of Three sum, gives 8·8 for the amount of inductive force. In the actual experiment the force obtained was 11·5, a result, therefore, sufficiently near to warrant further investigation, to ascertain whether the law which would seem to be indicated is correct, and whether it holds good with any other dielectric, such as glass, in which case the cause of the discrepancy, when resin is the dielectric employed, should be sought after.

I now proceed to conduction.

The law which governs the conduction of electricity has been very accurately ascertained, and would seem to follow the same law as induction, that is to say, if the sectional area be uniform throughout, the resistance which a conductor will oppose to the passage of a current will be directly relative to its length; or, the length of the conductor being determined, the resistance will be relative to its sectional area. In other words, a wire one mile long will oppose half the resistance of that which will be opposed by a similar wire two miles long; and two wires, each two miles long, placed side by side, which is the same thing as one of twice the sectional area, will oppose exactly the same resistance as a single wire one mile long.

The next thing to be considered is the part which the quantity and intensity of electric currents play in electric phenomena.

The amount of force developed by an electric current, whether it be the deflection of a needle, the attraction of an armature in an electro-magnet, or the decomposition of water, is always relative to the dynamic quantity flowing.

This fact has been well established, and the difference between quantity and intensity accurately defined; yet still, in practice, there is a want of a clear comprehension of the relationship of those terms.

Let a battery—say of ten pairs of elements, with ten inches of surface in each cell—be joined through a circuit perfectly insulated, and opposing very great resistance to the passage of the current; and the amount of force, or in other words, the dynamic quantity of electricity flowing, be weighed off by a magnetometer, and noted down. If now this battery be disconnected, and another of the same number of elements, but with twice the surface, be connected in its place, practically no more will be found to be flowing through the circuit than in the former case, the resistance which the wire opposes measuring out the quantity passing somewhat in the same way as the height of the column, and not the quantity of water, in a cistern, regulates the rate at which it flows from an orifice inserted in it.

Let the series be increased, and more will be urged through; and, if the number of cells be sufficiently numerous for practical purposes, the same dynamic quantity as a single cell would generate through a circuit of no resistance, will be found to be flowing.

In theory this point can only be approached, for the resistance of the wire can never be completely overcome. In theory, also, when the number of elements is not increased, the larger the surface the greater will be the dynamic quantity flowing, for the tension of the current is lowered in proportion to the amount of electricity flowing out of the battery; and, when drawing from a larger reservoir, which batteries of greater surface may be compared to, this same amount will not lower so much the general tension; consequently, there will be more intensity to urge the current through. But to return to practice. If the number of cells has been sufficiently extended so as to generate the same dynamic quantity as a single cell does through a circuit of nominally no resistance, a further addition to the series will not be attended with any beneficial effect, for there is already power enough to urge through all the electricity the battery is capable of generating; and the force developed is directly relative to the dynamic quantity flowing. Tension is only the medium by means of which this dynamic quantity is forced through the circuit.

It will be as well, perhaps, to define more precisely what is wished to be understood by the term resistance. When it is said that one circuit opposes twice the resistance of another, it is meant that the same tension of current will force half the dynamic quantity only through this circuit that it would through one opposing half the resistance; it follows that a given length of wire opposes the same resistance to half the dynamic quantity of electricity that half this length of wire does to double the dynamic quantity, and hence all circuits oppose to an infinitely small quantity of electricity an infinitely small amount of resistance.

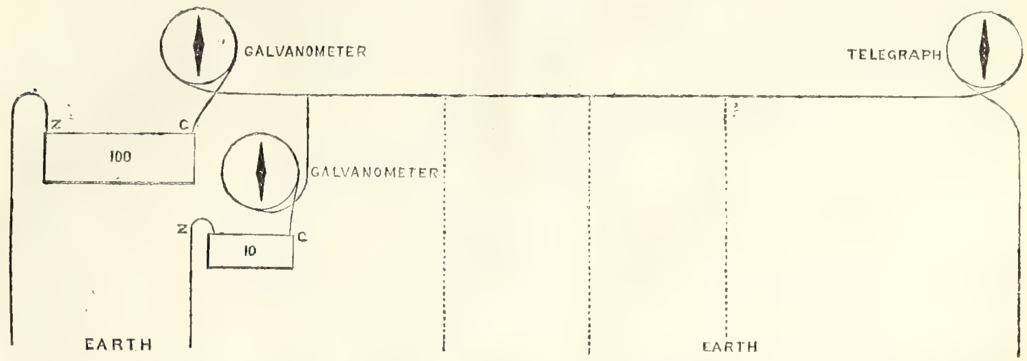
The way in which quantity and intensity affect practical telegraphing has next to be considered, and whether there be any advantage in employing comparatively large over smaller dynamic quantities of electricity.

It may be generally stated that when the insulation is very perfect there is no great difficulty in working with minimum quantities; but when the insulation is imperfect, larger dynamic quantities hold out a better prospect of working through.

When a current is flowing through a circuit which offers, practically speaking, no resistance, let the cells of the battery be ever so numerous, it will possess no intensity worth noticing, for, as there is no resistance opposed to the force resident in the battery, the intensity is not brought into play. It is something like a powerful engine raising a light weight, the force is latent, but not brought into action.

Let the battery, however, be connected through a circuit opposing considerable resistance; its intensity will then be developed,

Fig. 4.



Let the diagram (Fig. 4) represent a circuit which fulfils these conditions, one end of the wire dipping into the earth in the usual way, and the other connected with the copper pole of a battery composed of a numerous series of elements possessing very little surface and, consequently, capable of generating only a small dynamic quantity of electricity, and let the circuit be completed by connecting the zinc pole to the earth.

The current will flow from the copper pole through the wire, thence to the earth, and back to the battery, and its working intensity will be dependent on the resistance which the circuit opposes, and can be measured in the following manner:—

Let another battery, but with a much smaller number of elements, be connected side by side with the larger battery to this wire, the zinc pole being connected to the earth and the copper to the wire, and introduce galvanometers in the circuit, between the large battery and the wire and between the small battery and the wire, so as to indicate the direction in which the currents are flowing.

Both batteries will desire to send a current through the circuit in the same way, but should the small battery oppose much less resistance to the passage of a current through itself than is opposed by the long wire, then the greater quantity of electricity generated by the large battery will pass that way in preference to through the wire, and paralyze the action of the smaller battery; but if cell after cell be added to this little battery, when its intensity becomes greater than the resistance of the wire, a current will flow from it also in the same direction as that from the large battery through the wire, and the number of cells requisite just to do this will be an exact measure of the working intensity of the current.

Let the case now be considered where the insulation is not perfect; if there be sufficient leakage to let the small dynamic quantity, which the battery can only generate, escape on the road, no appreciable amount will reach the further end, the tension of the current will be lowered, and a less number of cells in the little battery will now be found to balance it.

Adding to the number of these small pairs of elements will not give any appreciable assistance, but let the surface in each of the cells of the larger battery be increased so that a greater quantity may be generated than can escape through the leaks, represented in the diagram by the dotted lines, an appreciable amount will then reach the further extremity, and the telegraph instrument be rendered active. In such a case as this, adding quantity will raise the working intensity of the current, whilst increasing the intensity of the battery alone will scarcely affect it.

In some experiments tried by my brother, Mr. Cromwell Varley, and myself, on long leaky circuits, increasing the surface of the batteries alone, without adding to the series, raised the deflection on the galvanometer from 22° to 53°; and the last intelligible words uttered by the Atlantic cable, "Daniells are now in circuit," is a further testimony of the correctness of what has just been advanced.

The correctness of considering the inductive phenomena which manifest themselves in subterranean and submarine circuits, as a new fact suddenly brought to light, has been called in question in the early portion of this paper; a few words on its history will therefore not be out of place, before considering the way in which it affects telegraphing.

In 1838, Dr. Faraday pointed out the conditions which would cause the retardation of an electric impulse in its passage through a conductor.

In 1848, the electric telegraph was in actual operation. The method adopted at that time for the insulation of the wires passing through towns, was to enclose a number of cotton covered wires in a leaden tube, and then fill the tube with a mixture of resin and Stockholm tar.

Reasoning on Dr. Faraday's observations, my brother, Cromwell Varley, was led to think that such circuits possessed conditions favourable for induction to manifest itself; he therefore searched for it, and succeeded in obtaining indications of induction.

In 1849, gutta percha had been introduced, and as the insulation in gutta percha covered wires was much more perfect than in the cotton covered ones enclosed in leaden pipes, induction manifested itself much more strikingly, and my brother made use of from that time as a more searching test of the perfection of the insulation than the deflection of a galvanometer, the capability of the wire to retain for a certain period the induced charge, and he stood alone for some time in making use of this test, others not having faith in it at that period, and in the same year he obtained indications of induction in an overground circuit.

In the latter end of the year 1851, my brother was enabled to experiment upon a length of ten miles of gutta percha covered wire. At these experiments I assisted, and the conclusion he arrived at was, that if gutta percha covered wires were employed for circuits of any length, as was at that time proposed, induction would manifest itself so powerfully, as to offer serious obstacles to telegraphing with the apparatus then in use, the truth of which prediction was subsequently verified. In Prussia, however, as early as 1850, Mr. W. Siemens had employed gutta percha covered wires for circuits of considerable lengths, and encountered the inductive phenomena, an account and explanation of which he published during that year.

This fact was not known on this side of the channel until after gutta percha covered wires throughout the whole lengths of the circuit were also employed in this country, and that was in the year 1854.

To Dr. Faraday, however, is due the whole credit in this matter, and I have only alluded to its telegraphic history, as I cannot help feeling it as a sort of reproach to practical electricians that it should go forth that induction, which was manifesting itself step by step before their eyes, came suddenly and unexpectedly upon them. The following extract from Dr. Faraday's researches of 1838 is so instructive, and teaches such a valuable lesson, that I cannot refrain from quoting it. Alluding to Professor Wheatstone's well-known experiment, he says,—"If the two ends of the wire were immediately connected with two large insulated metallic surfaces exposed to the air, so that the primary act of induction, after making contact for discharge, might be in part removed from the internal portion of the wire at the first instant, and disposed for the moment on its surface, jointly with the air and surrounding conductors; then, I venture to anticipate, the middle spark would be more retarded than before, and if these two plates were the inner and outer coatings of a large jar, or Leyden battery, then the retardations of that spark would be still greater."

Previous to the first attempt to submerge the Atlantic cable, a series of experiments were undertaken by the company's late electrician, and the result published.*

These experiments having been tried, at the expense of much capital, and with opportunities which never before presented themselves, are two important not to be noticed, though it is believed that the author of them has lately had reasons to modify some of his conclusions.

The chief results published were these:—

1. That no adequate result is obtained by increasing the sectional area of the conductor; that, in fact, in the case of a submarine circuit—a small wire will transmit signals more rapidly than a larger one.

2. That an insulated submarine wire conducts according to a different law to that of a suspended circuit.

3. That the rate at which a voltaic signal travels is not affected by the intensity of the battery.

4. That magneto-electric induced currents have the property of travelling in the first place faster than voltaic ones; and, unlike voltaic currents, when their intensity is increased their rapidity of travelling is increased also.

In the paper I submitted last March to the Institution of Civil Engineers, I pointed out what I conceive to be errors in these results, and endeavoured to show that some of them necessarily followed from the way in which the experiments were conducted, and I cannot more clearly express what I wish to convey on this head than by quoting my own remarks on that occasion.

"In examining these conclusions, it has first to be considered whether the conditions of a submarine circuit and a suspended one are different. In a suspended wire, the insulating medium of the air takes the place of the gutta percha of the submarine circuit. The earth, which is the nearest conductor, is a considerable distance off, and is only on one side of the wire, therefore but little induction can take place between the wire and the earth; nevertheless, induction to a certain extent does take place, and can be perceived in circuits of very moderate length.

"The author has noticed indications of it in a circuit 60 miles long, and he feels confident that with delicate apparatus it could be perceived in much shorter circuits. If the distance between the wire and the earth were decreased, induction would be developed more strongly, and the wire could be brought down step by step until the condition of a submarine circuit would be approached, where the earth surrounds the circuit on all sides, and is only separated from it by the thickness of one-eighth or three-sixteenths of an inch of gutta percha—a substance possessing, moreover, specifically a much greater inductive capacity than air. It, therefore, appears, that the conditions are precisely the same, only differing in degree. Before proceeding further, and to prevent the possibility of mistake, it is desirable to make the following quotation from the work previously referred to:—†

"'The law of squares may possibly apply to the transmission of electricity freely along simple conducting wires, but it certainly does not apply to the case of its transmission along submarine and subterranean gutta percha covered wires (the facility of transmission being estimated by rate of speed) because in this the case is not one of simple conduction, but of transmission, after the wire has been charged inductively to saturation as a Leyden jar.' This quotation shows clearly the reason for concluding that small wires are better conductors for submarine circuits, as far as transmission is concerned, than larger ones; for the smaller the Leyden jar the more quickly will it be charged to saturation. The author, in differing from these conclusions, does not wish it to be understood that he thinks the law of squares is applicable to submarine wires; for he is not aware of any electrical phenomena which obey that law, but he submits that there is a material difference between a Leyden jar and a submarine wire.

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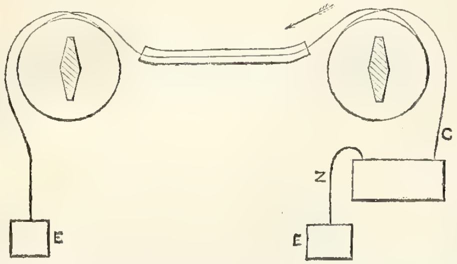
* *Vide*, "The Atlantic Telegraph. A History of Preliminary Experimental Proceedings, &c., published by order of the Directors of the Company."

† *Vide*, "The Atlantic Telegraph," page 23.

"In a Leyden jar the inner and outer coatings are perfectly insulated one from the other. If they were not insulated there could be no statical charge, as is well understood by all electricians. Induction therefore *involves insulation.* But in a submarine circuit this is not the case. If the wire at the further extremity was disconnected from the telegraph instrument, and sealed up with gutta percha, the conditions would be nearly the same. In practice, however, it is quite open through the instrument to the earth, and the resistance opposed by the very long length of wire is the only insulation between the inner and outer coatings, for it unites both, being in connection with the earth at both ends (Fig. 5).

Fig. 5.



It is therefore evident that if the wire offers no resistance there will no insulation, and, as a consequence, no induction to retard the passage of the current. It is also equally plain that precisely in proportion to the resistance which the wire opposes, provided always the insulating medium be of the same thickness, will induction manifest itself and retardation be experienced.

"There is also another difference between a Leyden jar and a submarine circuit.

"The Leyden jar is charged uniformly all over, whilst in a submarine wire the tension of the charge varies in different portions of the circuit, being at its maximum at the end where contact is made with the battery, and dying off to nothing at the further extremity."

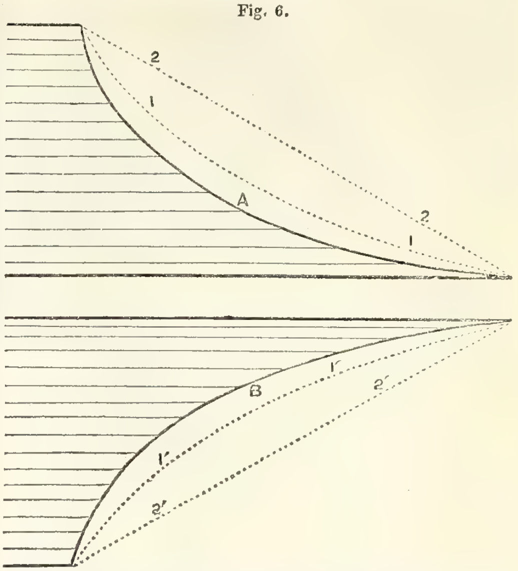
The next consideration is the part induction plays in submarine circuits of any considerable length.

In a submarine circuit the wire is insulated from the earth by only a thin layer of gutta percha; the conditions therefore are favourable for induction through the insulating material; the conductor itself, from its great length, opposes very great resistance, or, in other words, insulates to a very considerable extent.

When a battery is connected to send a current, the first impetus is in part directed forward, in part diverted laterally; but as the wire opposes considerable resistance to the passage of the electricity which the battery can generate, whilst the thinness of the insulating material is very favourable for induction taking place through it, the greater portion of the first rush will be occupied in charging the wire statically at the battery end; as, however, it is a balance of forces between the resistance which the wire opposes on the one hand, and the ease with which lateral induction can take place on the other, a very minute portion must pass through instantly, and the period which will elapse between the making contact with the battery and the observing the current at the further extremity will depend upon the capability of the instrument to record very small quantities of electricity.

In fact, immediately on contact being made with the battery, a wave will be formed throughout the length of the wire, somewhat like what is shown in the diagram (Fig. 6), which is intended to represent a submarine wire the moment after contact has been made with the battery.

Fig. 6.



The line A represents the internal charge having its maximum tension at the battery end, and diminishing in intensity as it approaches the farther extremity. The line B shows the induced charge of the opposite kind on the outer surface of the gutta percha, and forms an exact counterpart to the internal charge, with the exception of being a little less intense; for as it is spread over a greater surface, and only exactly balances the internal wave, its tension will be less in proportion as its surface is greater. As the tension of the statical charge is raised, so will the flow of electricity at the further extremity increase; both will arrive at their maximum together; the current will then flow in a regular stream as long as contact with the battery continues. The dotted lines 1 1 and 1' 1' are intended to represent the waves after the contact has been made a short time, and the lines 2 2 and 2' 2' are intended to represent the waves when they have attained their maximum height.

In the last case they will be perceived to be more regular.

When the battery has been disconnected from the wire, the opposite waves will still continue to unite, but the rate of flow as the tension falls will become slower and slower.

In theory the time which would be occupied by a wire discharging itself completely in this way would be infinite. In practice the wire requires a very appreciable time to charge, and a longer period to discharge. The effect of this is, that if currents are sent at all rapidly one after the other, instead of obtaining a series of distinct impulses at the further extremity, an undulating continuous current is received; and, as to obtain a telegraphic signal, the wire has not only to be charged to a certain degree of tension before an appreciable current is received at the further end, but has also to be discharged afterwards before another signal can be sent, the impulses which are obtained through such circuits as these are very sluggish.

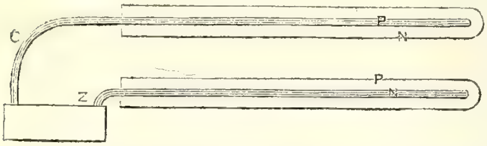
The problem to be solved is the best means of reducing the amount of induction, and of mitigating its effects.

Almost the first remedy suggested when this inconvenience was experienced, was to substitute another insulated wire in the place of the earth for a return circuit, for it was argued that, as in this arrangement, one wire would be charged positively and the other negatively, they would neutralise one another.

This suggestion was put to the test and failed. Since that time the same plan has been revived by several others; a good deal of argument has also been brought forward lately in support of it, and even amongst those, who know its practical inutility, there would still seem to have been lurking some faith in the capability of the method (in theory at least) to neutralise the effects of induction.

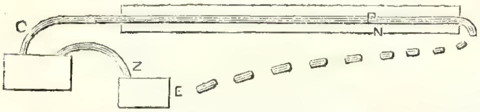
The explanation of its failure, if we are guided by the first principles of the science, appears to me to be very simple, and I expect not only to make it plain that no advantage is to be obtained by the adoption of this method, but that it will increase the retardation.

Fig. 7.



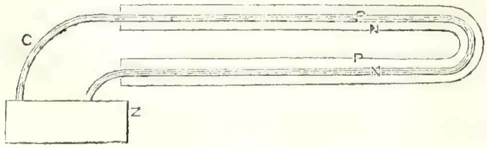
Let two long gutta percha covered wires (Fig. 7), buried in the earth, be connected, one with the zinc pole and the other with the copper pole of a battery, and let the farther ends of each of these wires be hermetically sealed. The earth, from its mass, being a perfect conductor, its action, it is evident, will be the same as if metal tubes in metallic communication with each other surrounded the gutta percha wires. It is therefore clear that the only retardation to induction will be the thickness of the gutta percha covering, and the tension of the statical charge will be in accordance with the intensity of the battery. Now consider the case of a similar gutta percha wire of the same length (Fig. 8) as one of these, but in which one pole of the battery is connected to the earth and the other to one end of the metallic conductor, and the circuit completed by connecting the further extremity to the earth. It will also receive a statical charge to a certain degree, but the tension of the charge will not, *ceteris paribus*, be dependent upon the intensity of the battery, but upon the resistance which the wire opposes, for it has already been shown that this is the only real insulation between the wire and outer coatings, and that the degree to which statical charge can take place depends on the amount of insulation existing.

Fig. 8.



Now, let the ends of the two wires vhich are hermetically sealed be connected to each other (Fig. 9), the circumstances are quite as favourable for induction as in the wire in which one end was connected with the earth, but there will be twice the resistance; in other words, double the amount of insulation, and, consequently, a proportionate increase in the amount of induction.

Fig. 9.



Another view of this matter will perhaps assist to confirm what has just been stated.

It is a well established fact that when a telegraphic circuit is composed of a loop of wire, it will oppose the same resistance as a circuit of double the length where the earth is made use of in the place of a return wire, and this proves that the earth offers no appreciable resistance. If this be the case, what difference can it make whether the battery pole be carried to the end of the wire itself, or through the medium of any length of a perfect conductor, which the earth has been proved to be. Therefore, it would appear that the induction which would be manifested in a circuit composed entirely of an insulated conductor, would be the same as that in a circuit of twice the length, where one half the circuit is completed by the earth, and the only difference which would exist between the one and the other would be, that in a circuit composed entirely of wire, the statical charge will be distributed more uniformly throughout the entire length.

But, says a writer on this subject, I admit that no advantage would result if two separate wires are used, and which will therefore necessarily be some distance apart from one another, but place the two wires in the middle of a mass of gutta percha (Fig. 10), and so close to each other that they may become virtually the centre of a system, and let the insulating material be of considerable sectional area, then no induction worth naming will take place between the wires and the earth, and the inductive influence of the positive wire will neutralise that of the negative wire.

Fig. 10.

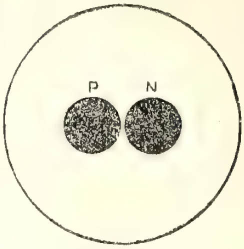
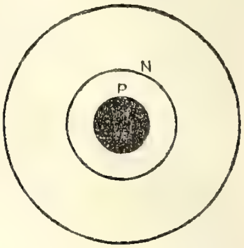


Fig. 11.



The fallacy of the proposition will be at once seen if it be carried out more fully. Instead of letting the wires lie side by side, let the one wrap over the other, and be, in fact, a tube with a thin mass of insulating material between it and the inner wire (Fig. 11). They will now become really the centre of the system, and fulfil completely the object desired by the author of this suggestion, but is it not evident that such an arrangement is the fac-simile of a Leyden jar, and will not the conditions be the most favourable that can be conceived for the development of induction?

The only remedy which has been successful in mitigating the effects of induction, is that of throwing into the wire, immediately after a current has been sent, another of the opposite kind; this absorbs and neutralises the preceding wave much more quickly than when the wire is left to discharge itself in the ordinary way. This method, however, does not reduce the induction, but only mitigates its effects, although in circuits of moderate length its adoption has, for practical purposes, completely removed the inconveniences arising from the induced charge.

There are only two ways of reducing induction, the one is to increase the thickness of the insulating material, and so render the conditions less favourable for its development, and thus approach the conditions of a suspended circuit, where the induction having to take place through a considerable space of air—a dielectric of very low specific inductive capacity—there is but little accumulation of statical charge, and consequently the impetus is almost entirely directed forward, and scarcely diverted laterally to any appreciable extent.

In gutta percha covered wires, when the insulating material is increased in size, it has been shown that the full effect of the increased thickness is not obtained, owing to the outer surface increasing at the same time.

There is also another quality possessed by resinous substances, and probably by gutta percha, worthy of consideration. It is the property of absorbing a charge in the mass of the substance, instead of its being confined entirely to the surface; the tendency of this will be to still further reduce the advantage of an increased thickness of insulating material.

A reference to first principles will make this clearer.

All bodies insulate to a certain extent, and the only difference between a so-called conductor and insulator that would appear to exist, is a difference of degree, and if a charged body is brought into the neighbourhood of an insulated conductor, induction will take place through it in the same way as through a dielectric, but owing to the particles of conducting substances possessing the property of readily communicating their forces one to another, the inductive force developed at the further extremity will, within certain limits, be scarcely affected by the length of the conductor through which induction is taking place.

The absorption of a charge within the substance of the dielectric is an approach to this condition, but its practical moment when gutta percha is the insulating substance has to be determined by experiment.

Lessening the induction by reducing the resistance has next to be considered.

The first thing obviously will be to obtain a metal of the highest specific conducting power, for could the sectional area be diminished without increasing the resistance, the induction would be reduced proportionately to decrease in the surface. The next will be to increase the sectional area of the conductor, and although this involves increased surface, yet there will be a gain; for when the diameter of a wire is enlarged, the surface over which the amount of induction extends does not increase in the same ratio as the sectional area which determines the resistance opposed by a conductor. To make this clearer, let four cables ranged side by side be employed as one conductor.

Such an arrangement will possess four times the sectional area, and oppose only one-fourth the resistance; in other words, the same tension of current will force through four times the dynamic quantity of electricity that would be generated through the single cable when used alone. Signals would not, however, be transmitted more rapidly through the four cables than through the one, for although the conducting power has been increased four times, the surface has been quadrupled also, which will exactly counterbalance the lessened resistance; but merge the four into one, the external inductive surface will then be halved, whilst the sectional area will remain the same as before, and there will be only half the induction manifested.

It therefore follows when a wire is enlarged, that as the sectional area increases as the square, whilst the surface increases only in regular proportionals, the relative balance of forces in favour of rapidity of conduction will, in a submarine conductor of a given size, be twice the amount of that in a wire of half the diameter.

I would now attempt an explanation of how it happened that an actual retardation was observed in some of the experiments with the Atlantic cable when a conductor of enlarged sectional area was employed; and on this head I would again quote from my remarks on a former occasion:—

"In the experiments to ascertain whether any advantage would result from the use of an increased sectional area of metallic conductor, recourse was had to joining the cables side by side, the increased inductive surface which such an arrangement involved having possibly been overlooked. This will account not only for an increased speed not having been obtained, but for an actual retardation having been noticed. Electro-magnetic induction coils do not create electricity, they simply offer a ready means of converting electricity of low tension and considerable dynamic quantity into electricity of very high tension and small dynamic quantity. The quantity evolved by them is always smaller in proportion as the intensity is greater. Both cannot readily be obtained together, and if a very high intensity is required, the quantity must be sacrificed, unless the size of the apparatus is immensely increased. This difficulty has evidently been appreciated, as the induction coils used by the Atlantic Telegraph Company are of large size and great length, so as to obtain high tension with an appreciable dynamic quantity. Nevertheless, there is little doubt but that the quantity evolved even by these machines, when compared with that generated from voltaic batteries, is small. This being the case, on giving the current a larger number of channels to rush into, there is not enough electricity to fill the wires, consequently the tension of the current will be very much lowered. The effect of this will be that a longer time will elapse before the tension of the wire will be raised sufficiently high at the further extremity to render itself apparent on the instrument. To obtain, under such conditions, the same speed with four cables as would be obtained with one alone, it would be necessary to employ four of these induction coils, ranged side by side, and worked with four times the battery surface, so as to generate four times the dynamic quantity of electricity. When qualified with these conditions, under which, no doubt, the experiments were tried, the reasoning contained in the Atlantic Telegraph Company's pamphlet, given in an earlier portion of this paper, is correct. It is precisely a case of having four Leyden arrangements to charge instead of one. A telegraph cable is, in fact, a Leyden arrangement, which has to be charged to a certain degree of saturation, before signals are obtained. The degree to which it has to be charged, statically, depends upon the extent of inductive surface compared to the conductibility of the metallic core. In a circuit where the conductibility of the metallic core is very great, compared with the inductive surface of the insulating material, no high degree of statical charge can take place, and signals will pass quickly. The opposite effect will be noticed in a circuit where the inductive surface is very large compared with the conductibility of the metallic core. The wire will then have to be statically charged very highly, before a perceptible current will flow from the further extremity, and signals will be obtained proportionately more slowly."*

The reason why signals are found to pass when magneto-electric induced currents are employed in place of voltaic ones arises, I believe, not from any specific difference between them, but simply from the tension of the induced currents being very much greater than any voltaic ones which have been employed.

On this head I will say nothing further here, but would refer those who may take an interest in it to my paper of a former occasion, where I have fully entered into this subject, and also attempted an explanation of how it has happened that in the experiments with voltaic currents, of varying intensities, no difference of speed has as yet been observed.

The amount of retardation which will be experienced in submarine circuits possessing conductors of varying resistance, and insulated with different thicknesses of insulating material, it appears to me can, comparatively speaking, be readily determined by actual experiment.

I have for a long time been engaged in designing an apparatus for this purpose, and at the time I arranged to give this paper, I fully expected to have had the apparatus completed by this time, and to have been able to have laid it before you on this occasion; and, though I regret not being able to do this, yet I feel I have sufficiently advanced to warrant my explaining the principles of its construction.

The principles upon which it is based are: that a body which offers the same resistance as another, without reference to its substance or length, may, as far as conducting power is concerned, be considered electrically the same. If we make use of a substance or metal of any inferior specific conducting capacity to that of the metal employed in submarine circuits, and also of greatly diminished sectional area, the same resistance as that offered by the very longest circuits can be obtained in a very small compass; and such an arrangement will, as far as simple conducting power is concerned, fairly represent a long submarine circuit.

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* *Vide*, "The Atlantic Telegraph."

The induction which manifests itself in submarine circuits can also be obtained if the conditions for its development are as favourable as they are in submarine conductors.

The apparatus consists 1st., of a series of resistances, the values of which are known.

2nd. Of a series of induction plates, the values of which, when compared with a given surface of a gutta percha coated wire are also known.

3rd. A mechanical arrangement to accurately measure minute periods of time.

By a combination of the resistances and the induction plates, a conductor, which will fairly represent a submarine circuit, will be obtained.

The resistance can be diminished or increased, and the inductive surface can be doubled or halved at pleasure, and thus circuits with conductors of varying lengths and sectional area, and different thicknesses of insulating material be imitated, and the law which governs the retardation in the transmission of telegraphic signals determined by direct experiment.

It may be argued that as the inductive surface in a telegraphic circuit is uniformly spread throughout, a series of induction plates will not present the same conditions, but it is evident that they may be divided throughout also, and although they will not then precisely represent what is actually the case, the result will approximate very closely to those obtained from a submarine conductor.

Perhaps it would have been prudent not to have called attention to an apparatus before its completion. I have done so, however, because I have felt it was due from me to endeavour, at least, to point out how some of the important problems involved in submarine telegraphic communications between distant stations may be resolved.

The chief deductions from what has been brought forward in this paper are :—

1st. That the metallic core of a submarine cable should be composed of a conductor of the highest specific conducting capacity.

2nd. That a decrease in the retardation which is caused by the induction that takes place in submarine circuits, can only be obtained by increasing the thickness of the insulating material, but that it will be better to do this by enlarging the sectional area of the conductor as much as is practicable.

In designing a cable there are many considerations besides those of its simple electrical qualifications which have to be entertained. The object to be obtained is the best result with the most economical investment of money. Are the proportions which were adopted in the Atlantic cable the best to ensure this?

The weight of the conducting coil in this cable is about 63lbs. to the mile, the value of which, speaking roughly, would, I suppose, be about as many shillings. When served with gutta percha its value was raised to £40 per mile. The iron sheathing and getting the cable on board brought its value up to £100 per mile. The expenditure, however, did not cease here; there was the hire of ships, salaries of staff, &c., &c. In this cable, therefore, only four per cent. at the outside was invested in the conductor upon which the transmission of the messages depended.

If the views which I have brought forward are correct, a conductor of double the diameter would only produce half the amount of retarding force of one of half the size. Such a conductor, at the very outside, would not cost more than £16 per mile, and the increased expenditure, in serving such a conductor with gutta percha, and giving it an iron sheathing, would not, comparatively speaking, be very large; the expenses of the staff and the hire of ships would be about the same in both cases; the latter would be, perhaps, increased slightly, but not to any material amount.

There are a great many other points which should be entertained in such a paper as this, but the paper has already run out to such a length that I will not trespass any further on your patience; and in conclusion I would only add, that if the ventilation of the subject, through the medium of this communication, should tend in any way to the progress of Electric Telegraphy, the object of its author which have been obtained.*

DISCUSSION.

The Chairman, in inviting the electricians present to take part in the discussion, would call their attention to the generally-scientific character of the paper, although there was a passage towards the close of it which opened up a practical question of great importance. Even if this had not been so, he thought in a society like this, where they dealt generally with the practical application of scientific principles, he would have been justified in inviting gentlemen to enter more particularly into the practical application of the theory which had been so ably brought before them. He would call their attention especially to one view which had been expressed very clearly with regard to the difference which existed between the Leyden jar and a long line of insulated wire with a distant termination connected with the earth. Mr. Varley had put before them what insulation practically was in such a case. It was not the separation of a body in an electrical state entirely from all surrounding substances, but the amount of resistance offered by the long wire before it terminated in the earth. This distinction had been brought before them in a very lucid manner, and he thought they were much indebted to Mr. Varley for having done so. He hoped gentlemen present would give their ideas as to the proportion of metallic conductor that should be used in long lengths of submarine cables, such as that between this country and America; also as to the mode in which the conducting medium should be constructed—whether of a single or a compound wire. This, however, was not the whole question; they had to consider not only the thickness of the wire and insulator, but also whether the insulating substance—gutta percha—was the best that could be adopted for the purpose, and whether before the next great experiment was tried with an Atlantic cable, they could not obtain further light with respect to the insulating medium that was best adapted to a length of cable of that description, both as to cheapness and the power of resisting the pressure of the water, although he thought cheapness in that part of the conductor was a matter of minor importance. It appeared that the conductor itself was only 4 per cent. of the whole cost of the last great experiment to America. The additional cost of the conducting medium, even to the extent of 8 or 10 per cent. was not to be considered for a moment, but the point was, whether by increasing the dimensions of the conducting medium, they did not at the same time increase the amount of induction. He should be glad to hear the views of Mr. Walker on this subject, as that gentleman's experience would be most valuable.

Mr C. V. Walker had attended to listen and learn, rather than obtrude his own views upon the meeting, but, being called upon, he would offer a few observations. The difference which Mr. Varley remarked between the Leyden jar and a submarine cable, was that which was generally recognised; it was simply a difference of degree as to the relative states of the inner and outer coating. The cable did practically possess all the distinctive character of the Leyden jar, notwithstanding that the inner and outer coatings were connected, as the experiments made with the Atlantic cable illustrated. The experiments worked out in the early part of the paper to determine the law of induction, would be found very clearly laid down by Sir William Snow Harris in the little book published by Weale. He had shown that the law of induction was inversely as the distance, and directly as the surface. The next clause of the paper referred to "intensity." This term had led to much confusion; moreover he thought in the present state of electrical science the conditions regarding conduction were far more completely expressed by the formula of Professor Ohm, than by Mr. Varley's diagrams. Another question in connection with submarine cables was the size of the conducting wires. This was a very important one, and he was quite sure they would think he was possessed of very little modesty if he ventured to give judgment upon a matter which, in his opinion, was so entirely a question of experiment that he only wondered the great cable was laid down before this important point had been satisfactorily investigated, so as to put the matter beyond the possibility of question, whether that conducting strand of seven wires was too large or too small. An opportunity occurred to him to try some experiments with seven or eight distinct miles of insulated wires of different sizes and different thicknesses of gutta percha insulation. The wires were in lengths of about one mile each, and the results of those experiments were decidedly in favour of a small wire as the conducting medium. There were many points in connection with small wires worthy of consideration, one of which was cheapness, because, although the per centage of saving upon a mile of wire was small, yet the saving would be very great in a cable to extend across the Atlantic. The smaller the wire was the greater the insulating power obtained from the same amount of gutta percha. The alleged advantage of the smaller wire was, that there was a greater resistance in the circuit; but, in the pamphlet published by the Atlantic Telegraph Company, the experiments made by Mr. Reid were described, from which it appeared that he sent a signal through 1,000 miles of cable with a battery of two plates only, excited by his tongue, so that the resistance to be overcome by that small battery could not have been great. Another point was the return wire, and upon that he considered the whole question of the Atlantic cable turned. What helped them on the one hand hindered them on the other. The effects of the magnetic disturbances of the earth would be obviated by a return wire. If two lines of cable were laid down and the current passed to Newfoundland by one wire and returned by the the other this inconvenience would be got rid of, but they would have the other inconveniences which Mr. Varley had laid before them. If the two wires formed portions of the same cable they would cause a greater amount of retardation, because one wire would polarise the other. But if two wires were used in the same cable in a somewhat different fashion, namely, if one was laid as the centre wire, and the other carried spirally round it, and the current divided between the two wires, the polarisation would be very much reduced, if not entirely annihilated. Those two wires, however, would act externally upon the outer coating, which would render the advantage nugatory. In his opinion the next Atlantic cable would not be coated with an iron jacket, as the former one had been; but a coating of hemp and other non-conducting materials would be employed. It might be interesting to the meeting to know the time it actually took to send signals through the Atlantic cable. By Whitehouse's induction coil it took 1¾ seconds, whilst the battery current was 6 seconds in its passage through, at least as far as he recollected.

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* See excerpt minutes of Proceedings of the Institution of Civil Engineers, Vol. xvi., Session 1856-57.

See "The Atlantic Telegraph. A History of Preliminary Experimental Proceedings, &c., published by order of the Directors of the Company," pages 20, 23, 25, 26, and 40.

See also the *Engineer* of December and January, 1858-59. "A discussion on the Induction in Submarine Circuits, by X. Y. Z., G. Blair, M.A., Telegraphic Engineer, and J. Tatlock.

Professor Tyndall said that the paper displayed a considerable amount of research, and an extensive acquaintance with the ordinarily accepted laws of electricity, as well as with the phenomena of retardation and induction. He would express the feeling that beset him, as he heard the paper read; and he spoke with all frankness and all respect to Mr. Varley and those, who, like him, were engaged in these researches, when he said that knowledge such as had been displayed in this paper, ought to be somowhat like the manure that was applied to agricultural purposes: it ought to be put underground, and new fruits ought to sprout from it. He had been looking intently for the results of this knowledge which had been brought before them; some of it was interesting, but, for the most part, it did not deal with facts, but rather with conjecture, more or less ingenious. The whole subject involved a complicated problem. There was not a shadow of doubt that each element of it could, by proper experiment, be separated from the rest, and its due influence described with certainty; and this was what ought to be done, instead of speculating upon the laws of electricity. He thought those speculations ought to be the private property of the man who worked the subject; they ought to guide him in his searches after facts; and if he produced the facts, he could then show the connection there was between the facts and the first principles of the science. He would refer more particularly to what he should himself like to see done. He had heard remarks about thickening the wire and the surrounding insulation. He would ask had any particular experiments been made to ascertain the law of, or the benefit to be derived from, thickening the wire? Had experiments been made to determine the law by which retardation was diminished, when the thickness of the gutta percha coating was increased? They could take the absolute wires that were to be used, and cover them with gutta percha and india-rubber, and compare them, and they could tell with certainty which was the best insulator. They could tell the influence of the thickness of the wire, and the thickness of the insulator; and he thought their knowledge of the principles of electricity ought to be the guiding light to carry their minds to the determination of these cardinal points.

Mr. Cromwell Varley said he could answer some of the questions put by Professor Tyndall. He had consistently recommended to the Electric and International Telegraph Company the use of wires of large diameter, for the last twelve years, as the only means of obviating the difficulties experienced on long circuits in wet weather from leakage, which, with the earlier forms of insulator used, was very great. Since the introduction of submerged wires he had pointed out the advantage that would be gained in such circuits of great length by the use of copper wire of large sectional area. On his recommendation the directors of the above-named company had tried both of these experiments on a large scale. They had erected iron wires of No. 3 wire gauge on the London and North Western Railway, on the Great Western, and the London and North-Western Railways instead of the usual size (No. 8). The results were such that he had no doubt they would never again, for long circuits (viz., of over 200 miles in length), erect other than thick wires. They had tried thick wire under the sea in their new cable connecting England with Holland. This cable contained four conductors of No. 13 instead of No. 16 wire, and although, for reasons explained further on, the relative speed of this compared with that of the former size was not so great, yet there was a very decided gain in rapidity, together with much stronger and much more uniform and reliable currents. These wires were connected both in England and Holland with a considerable length of overground wire, which latter was much affected by changes of the weather, and the gain in unfavourable weather from using the larger wire was, as predicted, very considerable. He was very much surprised to find Mr. C. V. Walker adhering to, and supporting, views which other well-known electricians had put forward, viz., that increasing the sectional area of the wire did not increase the rapidity of the transmission of electric signals. The experiment, however, had been lately tried in the new Dutch cable, and although the relative speed was not exactly known because there were many difficulties in the way, yet the fact was established that increasing the sectional area had greatly increased the speed. He had tried to determine the effects of induction, &c., on the speed of the electric wave; not only had the inductive effect to be taken into consideration, but also the absorption of electricity by the surfaces of the dielectric, and these influences were ever changing by heat and by the charging of the wire to such an extent that approximate results only were obtainable, which, however, were sufficiently near for all practical purposes. The absorption of electricity by the surface of the dielectric required time, and therefore cables of such length and dimensions as would only work slowly, suffered more from this absorption than shorter and quicker ones. The retardation of the wave in a cable was caused by the lateral induction absorbing part of the electricity intended to give the signal through the line, and until this charge approached the maximum the current at the distant end would be weak. If two cables were made, the one with an iron and the other with a copper conducting wire inside the gutta percha, all other things remaining the same, the former would have as much induction as the latter, because this had reference only to the surfaces of the dielectric. As the iron wire would only conduct at one quarter the speed of the copper, it would require, with a given electro-motive force, four times as long to transmit a given current. The electricity would require, in the case of the iron wire cable, four times as long to charge the gutta percha, by lateral induction, as the copper-wire would, consequently such a cable would have only one quarter the speed of the other. Were it possible to compress twice as much copper into the same diameter, and so double the conducting power without increasing the inductive surfaces, the speed would be immediately doubled. This was not possible, and the effect could only be obtained by increasing the sectional area of the wire; increasing this four times, doubled the interior surface of the gutta percha, which was the chief inductive surface, and, leaving out of consideration for a moment the exterior surface, the conducting power would be quaprupled while the induction was only doubled; hence there would be a gain in speed of from 1 to 2. But there was more still than this gained; first, suppose the diameter of the small wire to be unity, and the thickness of the gutta percha covering also unity, the exterior surface of the gutta percha would be 3, and the combined surfaces of the gutta percha would be $3 + 1 = 4$. In the second case, where the copper wire was doubled in diameter, and quadrupled in weight, there would be two for the inner surface of the gutta percha, and four only for the outer surface, instead of six—collectively, six instead of eight. Hence, doubling the diameter more than doubled the speed. The third gain from the large wire was, that, having a higher speed, there was less time for the absorption of electricity, and, consequently, the disturbance and retardation from this cause were less. Having a current of four times the power entering the cable, and the leakage being less in proportion to it, the current received at the distant end would be more than four times as powerful, and much more regular; the apparatus would be less frequently interrupted for adjustment, and would, consequently, work without intermission for a much longer period than the smaller wire. Mr. Walker had alluded to the Atlantic cable, and stated, in proof of the sufficiency of the diameter of the copper wire, the fact that a single element of water battery gave a current perceptible at the other end. He (Mr. Varley) contended that this proved nothing as to its ability to transmit intelligible signals. In an Atlantic cable we must have not only a wire capable of giving currents and signals, but of giving such currents and signals as should overcome the friction and inertia of the apparatus used for indicating them; these currents must be so powerful and constant, that, when the philosopher had left the cable to the ordinary manipulator, the currents should not fluctuate so much as to interrupt the intelligibility of the communications. The current must have such force, that the varying friction of the apparatus should not materially influence the recording of signals. In the Atlantic experiment these difficulties were overcome to a great extent by a most ingenious little instrument—Professor Thompson's reflecting galvanometer. In this instrument the only friction was that of a single thread from a silk cocoon, supporting a very short magnetic needle, only $\frac{1}{3}$ of an inch in length, which carried a small mirror made so light as to weigh only a grain or two. The mirror reflected back through a lens a ray of light, and thus without impeding its free action, or adding to its friction, a long but imponderable arm was added to the needle to magnify its motion. This little needle was rendered more or less nearly astatic, by placing a large magnet under it to neutralise the earth's magnetism, and thus a nearly astatic instrument, sufficiently rapid in action from its small dimensions, sufficiently sensitive by its long imponderable arm (or ray of light), sufficiently free from friction by being suspended from a filament of silk, was obtained, and by it the faint signals through the cable were rendered visible. These signals were watched by a clerk, and recorded by hand on a Bain's printing machine. He (Mr. Cromwell Varley) felt that sufficient credit had not been given to Professor Thompson for this instrument, without which the Atlantic cable would never have transmitted a single message, and the world would not have had this great experiment to guide them, as there would have been no means of ascertaining whether the cable had reached the bottom of the Atlantic without parting. Such an instrument, however, was not calculated to meet the requirements of a commercial undertaking, because the reflected spot of light was difficult to follow with the eye for any length of time, and was often recorded by the manipulator incorrectly. The current must have sufficient force to record itself. With regard to the insulating properties of gutta percha, when pure and free from moisture he had found it to rank amongst the best dielectrics, but this was not the condition of the gutta percha used on cables, which appeared to be porous and to contain moisture. When the gutta percha was sufficiently heated to free it from this, there was great danger of altering its character, and rendering it liable to become brittle and to crack. In the Atlantic cable, even before it had been put under water, the loss of current by leakage was so considerable that less than one-third of the original current only reached the distant end. Were the loss constant in quantity it would not so much matter, but wherever the current escaped through moisture, there was polarisation and ever-varying resistance at the leaky spot. As an example, he would quote one of many similar cases that had come under his notice. In one of the London and Liverpool wires, there was a defect in the Kilsby tunnel, caused by a filament of wood in the gutta percha, which was wet at this spot. This leak gradually got worse and worse, and sometimes offered a resistance equal to ten miles of the line composing the circuit, and at other times, especially after the continuous passage of a positive current for some length of time, it offered a resistance equal to more than a thousand miles of the circuit. The fault was situated nearly half way, roughly speaking, 100 miles from the end, and when it offered a resistance of only 10 miles, $\frac{1}{11}$ only of the current from London reached Liverpool, assuming the rest of the line perfectly insulated. When the fault from polarisation, &c., offered 1,000 miles resistance, the current which reached Liverpool was $\frac{10}{11}$ of that which left London; these fluctuations sometimes took place in a second of time. The formulæ for such a case was $e = \frac{E l}{l + y}$, where *e* was the current received at the distant end, E the current leaving the original station (London), *l* the resistance of the leak, and *y* the resistance of the line between the leak and the receiving station. Now in the former case, the current was amply powerful enough to work the instruments, and no inconvenience would have been experienced had the fault remained constant, but on the contrary, it was always varying in force, and to such an extent that it was impossible to work the line through only 200 miles in length. Thus it would be seen that, leaving out of the question induction, and its consequent diminution of speed, a conductor of sufficient size must be had to cause these leaks to bear only a small proportion to the current transmitted, in order that the received signals might be sufficiently regular and equal in force to record themselves with certainty and ease. Unless these conditions were attended to, the cable, as a commercial undertaking, would inevitably fail. With regard to the rapidity of conduction of the electric current, his opinion was that the current began to flow from the distant end *immediately* after the near end was connected to the battery. Electricity showed no signs of compressibility or elasticity, and was without inertia. Suppose, for a moment, that a cable was divided into several portions, each of which was without appreciable resistance, but separated from the next portion by a given resistance, the first portion, on coming in contact with the battery, would be instantly charged, and as instantly would begin charging the next portion, but to a lower degree than itself; this second portion as instantly charged the third portion, to, of course, a still lower degree; and this the next, and so on to the end. By careful reasoning on the known laws of electricity he had come to the conclusion that the current began to flow out of the distant end instantly, but so feebly at first that the most delicate instruments failed to show it. Before concluding, he would draw attention to the unhappily chosen terms "quantity" and "intensity." What in England was generally understood by "quantity," was in Germany termed intensity or I. What in England was termed "intensity" or tension, was the electromotive force; in other words, the $I = \frac{E}{R}$, where I represented the power of the current to decompose a given quantity of an electrolyte, E the electro-motive force of the current, and R the resistances of the circuit. These terms had unfortunately led many into error, more especially the word "intensity."

Mr. C. W. **Siemens** agreed with much that had been said in the paper. He was decidedly in favour of a large conductor of the very best specific conducting power; and had maintained from the first that the conductor of the Atlantic cable was totally inadequate. When he read a paper last year before this Society, he had expressed the laws by which the proportion of an electric cable should be regulated for a given length by a simple formula; and he thought that a mathematical expression properly explained was preferable to an explanation in words only, even for a popular assembly like the present, because it combined all the elements to be taken into consideration. He did not agree with Mr. Varley that an electric wave on entering a submerged conductor at one end presented itself, in however slight a degree, instantaneously at the other. The laws of induction and conduction, as he understood them, were directly opposed to such an assumption; and in his own experience he had certainly never observed any indication of it. The line expressing the relative amount of charge at different points of the electric wave in the conductor, was expressed not by a dynamical curve, as Mr. Varley had shown it, but by a straight line, terminating abruptly upon the horizontal line which represented the conductor. Another portion of the paper dealt with the complete metallic circuit in submarine conductors, which it was generally understood had been first proposed by his (Mr. Siemens') brother. Mr. Siemens could not agree with the views expressed by Mr. Varley, and by several others who had lately written in the scientific journals upon this subject. Some of them seemed to lose sight entirely of the most essential condition, namely, that the two conductors were to be embedded in the same insulating medium. His brother had never for a moment assumed, as seemed to be supposed, that lateral induction between the two conductors constituting the circuit would be obviated. On the contrary, it would be rather increased on account of the greater resistance of the metallic circuit. But it was maintained that the charge between the conductors and the larger surface of the sheathing would be nearly entirely obviated; that the working of one metallic circuit in a multiple cable (which his brother had chiefly in view) would not disturb the electrical equilibrium of the other conductors; that the losses by leakage would be reduced, enabling him to reduce also the area of the conductor, and thereby also the lateral induction between them, that the metallic circuit was not affected by magnetic storms, and finally that considerable advantage could be obtained by the mutual acceleration of the positive and negative currents by Volta induction. So long as a single conductor could satisfy the public demand for messages, the advantages of a metallic return wire would probably not warrant the additional expense, but wherever several conductors became necessary, the advantage of working through metallic circuits would be very great. Mr. Varley's illustration of surrounding the one conductor by the other (in the form of a tube) did not meet the case, because the tubular conductor possessed the very condition which it was intended to avoid, namely, an extended inductive surface both against the inner conductor and the outer sheathing. Mr. Siemens had only one other point to remark upon, and that was of an historical nature. Mr. Varley had stated that Mr. W. Siemens had first employed gutta percha coated wires in Prussia in 1850, where he had observed the phenomena of induction also. It was, however, in 1847 when the first gutta percha coated line wire was laid down successfully near Berlin; and he (Mr. Siemens) exhibited specimens of it, and explained the phenomena of charge which had been observed, before this Society in 1848. He might also observe that the statements which had been circulated, that the gutta-percha coated wire, as first prepared in Prussia, had proved an entire failure, were very unfair towards his brother. These wires had been coated in the same manner as they were at the present day, although it must be admitted that the quality of the gutta percha employed was very inferior. These lines had, however, done good service for four or five years, when they began to fail; some of them had, however, lasted much longer, and some—covered with lead—were actually in use to the present day. He did not think that a much more favourable result had since been obtained elsewhere.

Mr. **Leonard Wray** said he would make but a few brief remarks upon some of the points under discussion. In the first place he considered that the paper read by Mr. Varley was a very valuable and instructive one, for which all present must feel indebted to him. Let the ideas brought before the Society that evening be designated as mere conjectures, or theories, or what not, still he ventured to differ from Professor Tyndall's opinion, that Mr. Varley should have confined them to his own breast until he had fully tested and proved them practically, inasmuch as Mr. Varley, by giving publicity to them before that Society had, in fact, laid them before the whole world of science, and the result would be, that instead of these ideas remaining stored up in his own mind alone, to be worked out solely by his own individual energies, there would now be many, very many, minds brought to bear upon them, and to assist in reducing them the more speedily to the test of practical experiment. The next point he would remark upon was the best diameter for the conductors of electric telegraph cables, a subject which was so very much discussed, and so very much disputed, that he would only present to the notice of the Society one very singular and significant fact bearing upon the question. When telegraph wires were first introduced into India, Sir W. O'Shaughnessy and his staff were sadly annoyed by the continual breakings of their wires, caused by very large birds alighting upon them. To remedy this nuisance that gentleman employed very thick, strong wires, which these birds could not injure; and this great increase in the size of the wires brought out the remarkable fact that no insulation whatever was necessary at the posts, around which they were simply wound. This deserved, he thought, to be recorded in such a discussion as the present. The third and last subject to which he (Mr. Wray) would refer, was that of insulation. Now, the substance almost universally used as an insulating material was gutta percha; but they were told, and many of them knew it as a fact, that gutta percha absorbed no inconsiderable quantity of electricity; indeed, that it became, to a certain extent, saturated with it. Such being the case, it must be evident that gutta percha was by no means a perfect insulator, for he held it as an axiom, that no really good and perfect insulator would absorb electricity. The greater the quantity of electricity absorbed by the insulating material used, the greater would be the retardation of the current. Hitherto, then, a substance had been employed which was very far from perfect, and all calculations had been based upon its known insulating properties; but if they had a superior—a very much more perfect insulating material—would it not be possible to construct cables with a far less quantity of that material than gutta percha? He thought so, and he moreover believed that such an insulating material as he had spoken of would, very probably, be soon discovered.

Mr. S. Alfred Varley said he had but little to reply to, as no attempt had been made to refute the views he had brought forward. He was unable to follow Mr. C. V. Walker throughout, and he did not clearly see the direction in which his views tended. Mr. Walker appeared to object to the statement made, that there was a difference between an ordinary Leyden jar and a submarine circuit; yet he admitted that the conductor united the inner and outer coatings of a submarine w ire when regarded as a Leyden arrangement, and that the resistance it opposed was the only thing which prevented the free flow from the one to the other; now he (Mr. Varley) thought this was a most important admission, for upon it depended the reason why a large wire conducted more rapidly than a smaller one, and this was no longer a theory, but an ascertained fact. If there were no difference between a submarine wire and an ordinary Leyden jar, and if a submarine circuit had to be charged statically to saturation before signals passed, as was stated to be the case by the advocates of the small wire system. then it would be clear that as the greater the sectional area, the larger the Leyden arrangement would be, there would be more retardations with larger conductors, as more electricity would be required to charge them. He maintained that, in practice, a submarine circuit was not charged to saturation; the degree to which it was charged statically depended upon the relative balance between the conditions which favoured induction and conduction; if the conditions, as had been stated in the paper, favoured conduction. there would be less statical charge, and a greater proportion of the electrical impulse would be directed forward, and signals would be obtained more quickly. He fully concurred in all the views expressed by Professor Tyndall, and quite agreed with him as to the desirableness of searching for facts with actual submarine circuits of varying dimensions; but when these were not at command, he thought we should not wait for such favourable conditions for experimenting, but should endeavour to obtain the best substitute we could. Moreover, if it were possible to obtain all the conditions which submarine circuits presented in our own private laboratories, this would be a positive advantage, for the whole being under immediate command, and not disturbed in any way by atmospheric causes, more or less defective insulation, or other disturbing influences always occurring more or less in practice, we should be enabled to trace out principles more clearly and have fewer sources of error to eliminate. Mr. Siemens, when considering the question of the complete metallic circuit *versus* the earth for one-half of it, objected to the fairness of the diagram in which one of the conductors was made into a tube. This diagram was introduced, as was stated in the paper, as an exaggeration, simply to show the fallacy of the principle; and although, as was stated by Mr. Siemens, the wires would not, when side by side, present as much surface to induction as an ordinary circuit, yet it must be borne in mind that there would be just twice the resistance of that which would be opposed when the earth was employed for one-half of the circuit, and this would more than counterbalance the lessened surface exposed to induction. He agreed generally with the remarks made by Mr. Wray. There was no doubt that with large conductors imperfect insulation was less felt, but the result in Sir W. O'Shaughnessy's case was probably not altogether due to the size of the conductor, for it must be remembered that the climate was very hot and dry. As a practical fact, he (Mr. Varley) would state that when in the Crimea they never obtained what telegraphists termed a "perfect earth." In the submarine circuit between Varna and Constantinople, contact with the earth was made by connecting a wire to the iron sheathing of a piece of the cable, more than a quarter of a mile in length, which was buried in the earth, and passed through the British Embassy grounds, yet, notwithstanding this extensive surface, in hot weather he found the earth, to use a telegraphic expression, very far from "perfect," and he remedied this by carrying a wire out into the Bosphorus.

The Chairman said, before proposing the usual vote of thanks, he would express his opinion of the result of the discussion that evening. They had advanced very little in practical knowledge since the failure of last year with the Atlantic cable; but the proper way of doing so was to follow the course pointed out by Professor Tyndall. At the same time he thought it was well that theories should be advanced with a view to set men thinking; but the professor no doubt meant to pay Mr. Varley the compliment that his knowledge of this matter would be better applied to the practice than the theory of the subject. But Mr. Varley was, in fact, doing what had been asked of him; and it was only owing to some delay in the completion of an elaborate instrument that he was not able to lay before them the results of actual experiment. The *experimentum crucis* was what they really wanted; wires of different conducting powers tested against each other, and the results ascertained by the best class of instruments, and, he would add, by a variety of experimenters. He found that electricians still remained true to their colours, in the absence of positive results, one way or the other. His friend Mr. Walker still adhered to the small wire, whilst others appeared as the consistent advocates of a large wire as the best conducting medium. In this country, such opportunities were presented for experiment upon a large scale, that they had nothing to fear from theory; and he hoped such experiments would be made as would solve many of the points upon which so much diversity of opinion now prevailed. He would now propose a vote of thanks to Mr. Varley for his able and interesting paper.

The vote of thanks having been passed,

Mr. **Varley** acknowledged the compliment. He said he had taken up the subject from an earnest desire for the progress of the science, and from a strong feeling that great errrors had been introduced with regard to the Atlantic Telegraph cable, which, coming from those who had had such extraordinary opportunities for experiment, were likely to mislead.

The Secretary announced that on Wednesday evening next, the 6th April, a paper by Mr. George Wallis, "On Embroidery by Machinery," would be read.

Home Correspondence.

ARTS AND MANUFACTURES EXHIBITION IN THE WEST OF ENGLAND.

Dear Sir,—The facts that H.R.H. the Prince Consort has become a member of the "Bath and West of England Society for the Encouragement of Agriculture, Arts, Manufactures, and Commerce, founded 1777 A.D.," and that the Committee of Council on Education have made a special exception in favour of the Society, in order to allow the selection of decorative works of art from South Kensington Museum to be exhibited at the North Devon meeting at Barnstable, may justify me in asking you to allow me again to invite the attention of the members of the Society of Arts to the objects of that meeting.

The Council of the Society, building on the steady progress of their agricultural gatherings, on the increased business done in the sale of agricultural implements, on the improved demand for education and scientific instruction, which has arisen in the west of England, and on the complete organisation and harmonious action of the Society, have opened a new department of "Arts and Manufactures" for exhibition and sale. A special fund has been raised for a moveable building, to be used next year at Dorchester; an admirable plan has been furnished by Mr. Nicholson, Agricultural Engineer of Newark; and the support of the principal local dealers and manufacturers has been obtained.

The idea of the Exhibition, confessedly a novel one, gains ground in public estimation. It is recognised as not only good, but practicable. The idea is this, that the summer gatherings of thousands of persons attracted by the sight of live animals, steam ploughs, poultry, and music, may be made to minister to improvement in taste, if good and beautiful objects are placed before the visitors.

The migratory meetings of the British Association for the advancement of science, of the Royal Agricultural Society, the local examinations of the Universities and of the Society of Arts, have all tended to show that the civilizing action of railways must, in order to produce full results, be centrifugal as well as centripetal; and that a pleasant holiday in the country is appreciated by many hard-working townsmen, who are not directly interested in the business of the meeting.

All that is wanted is a little energy, a little common sense, and a pervading spirit of harmony and goodwill among the managers of the first experiment. If the plan is a good one, and well worked out on a moderate scale, it is sure to be supported, and will be followed elsewhere.

Encouraging replies and promises of articles for exhibition and sale have been received from the metropolis, from the Midlands, and from the North of England. The arrangements for protection and the charges for space appear to give satisfaction, being met on the part of exhibitors by a candid and liberal appreciation of the facts of the case.

Pottery, glass, metal work, and wood work, in their most attractive forms, will be well represented. The same may be said, so far as patterns are concerned, of textile fabrics; but the scale of the Exhibition hardly admits of the exhibition of pieces of cloth or prints, nor is there perhaps the same need for special efforts in these departments.

There will be an exquisite exhibition of water-colour drawings and sketches; the artists of the West of England need not fear comparison with all England. But in addition to the works of living artists, collections of the most precious kind, including works of Turner, and other eminent artists, such as few have an opportunity of seeing, will be opened to the public in a manner which reflects the highest credit on their possessors.

The exhibition will open on the 30th of May, and last for the week. Alas! it is the week of the Derby; but we have entered, and now we must run.

The entries close on the 16th April. Forms of entry may be had on application to Mr. George Down, Honorary Secretary, Cathedral-yard, Exeter.

I am, &c.,
THOMAS DYKE ACLAND, Jun.,
Chairman of the Arts and Manufactures Committee.
Sprydoncote, Exeter, March 28, 1859.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 2. General Monthly Meeting.
London Inst., 7. Mr. John Ella, "On Chamber, Orchestral, and Ballet Music."
Entomological, 8.
Brit. Architects, 8.
Medical, 8.
Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Civil Engineers, 8. 1. M. Alphonse de Brussaut, "On a New System of Axle-boxes and Journals for Machinery without Oil." 2. Mr. B. McMaster, Assoc. Inst. C.E., "On the Permanent Way of the Madras Railway."
Pathological, 8.
Photographic, 8.
Wed. ......London Inst., 3. Mr. E. W. Brayley, "On Meteorology."
Society of Arts, 8. Mr. George Wallis, "On Embroidery by Machinery."
Geological, 8. 1. Dr. T. Wright and Mr. R. Etheridge, "On the Inferior Oolite of Gloucestershire compared with that of Yorkshire." 2. Mr. E. Hull, "On the South-Easterly Attenuation of the Lower Secondary Rocks of England."
Pharmaceutical, 8.
Royal Soc. Literature, 8½.
Thurs .....Royal Inst., 3. Prof. Tyndall, "On Pneumatics."
Royal Soc. Club, 6.
London Inst., 7. Professor Bentley, "On Vegetable Substances used for the food of man."
Antiquaries, 8.
Linnæan, 8. 1. Mr. Barter, "On the Vegetation of Western Africa." 2. Dr. James Salter, "On the Cranial Characters of a Rat new to the British Fauna." 3. Dr. Salter, "On the Moulting of the Lobster and Shore Crab." 4. Dr. Sandwith, "On the Habits of the Aye-Aye."
Chemical, 8. 1. Dr. Odling, "On the Atomic Volume of Lithium." 2. Mr. N. Tate, "On some Experiments with Boracic Acid."
Artists and Amateurs, 8.
Royal, 8½.
Fri..........United Service Inst., 3. Capt. Chesney, "New Zealand considered as a Field for the Emigration of Military Men."
Astronomical, 8.
Royal Inst., 8½. Mr. James Paget, "On the Chronometry of Life."
Sat. ......Asiatic, 2.
Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."
London Inst., 3. Mr. E. M. Brayley, "On Meteorology."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 26th and 28th February, 1859.

50. Local Acts (15, South Wales, Pembroke, and Tenby Junction; Railway; 16, London Bridge and Charing Cross Railway 17, Lancaster and Carlisle Railway; 18, Birkenhead, Lancashire, and Cheshire Junction Railway; 19, Wells and

Fakenham Railway; 20, St. George's Harbour Acts Amendment; 21, Cowes and Newport (Isle of Wight) Railway; 22, Londonderry and Lough Swilly Railway; 23, Isle of Wight Ferry Company; 24, Charleston Railway and Harbour; 25, Dundalk and Enniskillen Railway; 26, Isle of Wight Railway (Eastern Section); 27, Chester and Holyhead Railway; 28, Malden and Sheen Valley Drainage;) — Admiralty Reports.

33. Bills—Superannuation (Amended).
37. „ Adulteration of Food or Drink.
44. „ Roman Catholic Oath.
38. „ Conveyance of Voters.
45. „ Law of Property and Trustees Relief Amendment.
42. „ Masters and Operatives.
43. „ High Sheriff Expenses.
22. „ Bankruptcy and Insolvency.

Delivered on 1st March, 1859.

47. Education—Return.
62. Lighthouses—Return.
86. Bankruptcy (Scotland)—Report of the Accountant.
88. Shipping—Returns.
46. Bill—Trial by Jury (Scotland).
48. „ Manor Courts, &c. (Ireland)—Amended.

Delivered on 2nd March, 1859.

60. Irish Reproductive Loan Fund—Account.
80. Harbour, &c. Bills (1. Falmouth Docks and Harbour)—Board of Trade Report.
89. Committee of Selection—2nd Report.
91. Lighthouses—Copy of the Royal Commission.
53. Criminals (Scotland)—Return.
6. Railway and Canal Bills (79, Belfast and Londonderry Junction Railway; 81, Brecon and Merthyr Tydfil Junction Railway; 82, Breconshire Railway and Canal (No. 1); 83, Charleston Railway and Harbour; 84, Cowes and Newport (Isle of Wight) Railway; 85, Dundalk and Enniskillen Railway; 86, Findhorn Railway; 87, Gateshead Quay; 88, Gloucester and Cheltenham Tramway Abandonment; 89, Hereford and Brecon Railway; 90, Holywood and Bangor Railway; 91, Llynvi Valley Railway; 92, Londonderry and Coleraine Railway; 93, Midland Great Western Railway of Ireland (Cavan to Clones, &c.); 94, Midland Great Western Railway of Ireland (Sligo Extension); 95, Mountsorrel Railway; 96, North Western Railway of Ireland; 97, Portsmouth and London and South Western Railway; 98, Ringwood, Christchurch, and Bournemouth Railway; 99, Sevenoaks Railway; 100, Silverdale and Newcastle-under-Lyme Railway; 101, South Staffordshire Railway; 102, Stokes Bay Railway and Pier; 103, Swanage Railway and Pier; 104, Tralee and Killarney Railway; 105, Victoria Station and Pimlico Railway; 106, Wansbeck Railway; 107, Witney Railway (No. 2); 108, Worcester and Hereford Railway—Board of Trade Reports.
39. Bills—Manslaughter.
47. „ Recreation Grounds.
49. „ Representation of the People.

Delivered on 3rd March, 1859.

87. Post Office—Copies of Letter and Treasury Minute.
90. Army Grants (deficiency for the year 1857-8)—Statement.
93. Funded Debt, &c.—Return.
96. Re-committal of Prisoners—Return.
97. Navy (Men voted 1815 to 1858-9)—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, March* 25, 1859.]

Dated 8th February, 1859.

350. J. Hosking, Walworth common, Surrey—Imp. in the manufacture of lamps.

Dated 24th February, 1859.

498. H. B. Barlow, Manchester—Imp. in apparatus for condensing steam. (A com.)

Dated 2nd March, 1859.

546. J. T. Carter, Belfast—Imp. in machinery for crushing, bruising, and preparing flax, hemp, and other fibrous materials requiring such treatment.

Dated 9th March, 1859.

609. J. Pilbrow, Tottenham, Middlesex—Certain imp. in, or a new method or methods of obtaining and applying motive power, a modification of which is also applicable for pumping or forcing liquids, gases, and fluids, as also for measuring liquids, gases, and fluids.

611. Sir W. G. Armstrong, Newcastle-upon-Tyne—Imp. in rifled ordnance and its projectiles.

613. J. Erwood, 132, Goswell-street, Clerkenwell, and J. Skertchly, Ashby de-la-Zouch, Leicestershire—Imp. in the manufacture of glass, sand, and emery papers and cloths, and other similar articles used for like purposes.

615. J. S. Russell, Great George-street, Westminster—Imp. in building ships and other vessels.

617. A. V. Newton, 66, Chancery-lane—Improved machinery for rolling horse shoe iron. (A com.)

619. H. Fisher, Birkenhead—Imp. in machinery or apparatus for cutting thin sheets of metal into strips, and for tempering sheets or strips of metal.

Dated 10th March, 1859.

621. J. Yuill, Glasgow—Imp. in saddle trees.

623. H. Lodge, Liverpool—Improved means of protecting ships, batteries, and other constructions or buildings from the effects of projectiles of various kinds.

Dated 11th March, 1859.

625. J. C. Haddan, 4, Cannon-row, Westminster—Imp. in casting mortars and cannon.

627. S. Wheatcroft, Brudenell-place, New North-road—Imp. in the construction of goffering and rouching machines in order to render them self-registering and self-indicating.

629. F. Clarke, Norland-square, Middlesex—An improved mode of and apparatus for cutting, drying, and preparing peat to be used as fuel, or for other purposes for which it may be usefully employed.

Dated 12th March, 1859.

631. J. Cunliffe and F. Piggott, Manchester, and G. Mallinson, Salford—Imp. in the manufacture of ornamental woven fabrics.

633. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of shoes and other coverings for the feet. (A com.)

635. J. T. Calow, Staveley, Derbyshire—A compound action in cage machinery, with the apparatus connected therewith, having a perforated shield for saving life and property in the event of a rope, band, or chain breaking, or the engine man drawing the cage too high at coal or other shafts, where slides are applicable, which said invention is also applicable to hoisting or other lifting machines.

637. J. Court, Brompton-row, Middlesex—An imp. in nibs for gas burners.

639. J. Macnab, Linlithgow, N.B.—Imp. in telegraphing or signalling apparatus.

Dated 14th March, 1859.

641. R. A. Brooman, 166, Fleet-street—An improved method of treating wool and other fibres in order to form threads. (A com.)

643. T. Lightfoot, Accrington, Lancashire—Imp. in fixing colours on woven fabrics or fibrous materials.

645. C. H. Hurst, Victoria-terrace, Royal-road, Kennington-park—An improved wrench or spanner.

647. T. Patstone, Birmingham—Imp. in shades or glasses, for gas and other lamps, and in the supports of the said shades or glasses.

Dated 15th March, 1859.

649. W. Langton, 14, Wharf, Belvidere-road, Lambeth—Imp. in the manufacture of keys and wood fastenings used in constructing railways.

651. G. B. Galloway, Newcastle-on-Tyne—Imp. upon, and in connection with, his former patents, and in the manufacture of fuel, and working steam engines more economically.

653. W. Clark, 53, Chancery-lane—Imp. in the apparatus of electric lamps or lights. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATIONS FILED.

656. G. Seymour, 6, Golden-square, Regent-street—Imp. in making refined sugar, and making potash and soda from the residues. (A com.)—16th March, 1859.

667. J. Harris, junr., Massachusetts, U.S.—A new and useful or improved carpet sweeper.—16th March, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, March* 25, 1859.]

March 25th.
2161. W. Lander.
2169. J. Manning and T. Paul.
2173. T. Britt.
2216. M. Jacoby and F. Rainford.
2224. D. Scattergood and R. W. Smith.
2242. T. Roberts and J. Dale.
2272. W. Johnston and W. Ross.
2280. Robert Ridley.
2306. G. T. Bousfield.
2326. A. W. Drayson and C. R. Binney.
2338. J. Grant.
2343. R. Griffiths.
2365. C. Clay.
2487. W. Ziervogel.
224. R. Rodmer.
325. J. M. E. Masson.

[*From Gazette, March* 29, 1859.]

March 18th.
2174. J. Wright.
2193. J. Rogers.
2233. Louis A. Normandy.
2269. J. F. Swinburn.
2271. T. C. Shaw.
2291. T. Ingram.
2308. L. Marcus.
493. Emile Alcan.
2809. M. A. F. Mennons.
221. W. Tasker.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, March* 25, 1859.]

March 21st.
677. J. H. Johnson.
680. H. Brierly.
March 22nd.
678. J. Jones and A. C. Shirreff.
708. G. H. Cottam and H. R. Cottam.
720. T. B. Daft.
740. W. F. Thomas.
788. W. Roberts.
964. D. Lloyd.
March 23rd.
692. James Robertson.
705. W. Foster.

[*From Gazette, March* 29, 1859.]

March 24th.
739. C. J. Dumery.
765. A. Guido.
809. F. W. Kitson.
850. A. C. L. Devaux.
March 26th.
747. J. Harrison.
749. J. Harrison.

Journal of the Society of Arts.

FRIDAY, APRIL 8, 1859.

◆

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

EXAMINATIONS, 1861.—LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Blandford.

Mr. Spence Abbott.
Mr. Edward Fisher.
Mr. Wellington E. Groves.
Mr. James B. Green, Blandford Institution, *Secretary.*

For Canterbury.

The Very Rev. the Dean of Canterbury.
The Rev the Sub-Warden of St Augustine's College.
Rev. J. B. Kearney.
Rev. E. R. Orger.
Monsieur L. L. Razé.
Mr. James Reid.
Rev. E. Gilder, Canterbury, *Secretary.*

For Carlisle.

Mr. Joseph Barnes, Schoolmaster.
Rev. Wm. Bell, M.A., Head Master of the Cathedral Grammar School.
Rev. J. G. Doman, M.A., Second Master of the Cathedral Grammar School.
Rev. T. G. Livingston, M.A., Minor Canon, Carlisle Cathedral.
Mr. James Barnes, Church of England Religious and General Literary Association, Carlisle, *Secretary.*

For the Royal Polytechnic Institution Classes, London.

Dr. White, *Chairman.*
Mr. J. P. Bidlake, B.A., F.C.P.
Mr. E. V. Gardner.
Mr. H. Hagrom.
Mr. J. C. Buckmaster, *Secretary.*

EXAMINATION PRIZE FUND FOR 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
— Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman.

PRIZE WRITING CASE.

The Prize of Twenty Pounds (placed at the disposal of the Council of the Society of Arts by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's Silver Medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., have been awarded to Messrs. Parkins and Gotto, of Oxford-street.

When the announcement of the offer of the Prize was first made, sixty-two Writing Cases were sent in for competition, but the Committee appointed by the Council to report thereon, came unanimously to the conclusion that none of them showed sufficient merit to justify the Council in awarding the Prize.

The Council then decided to invite further competition, and issued the following conditions:—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breath must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*—It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

In reply to this announcement, twenty-eight writing cases were sent in, and after careful examination, the committee reported in favour of a case, manufactured in accordance with the above conditions, by Messrs. Parkins and Gotto.

The retail price of the case will be 1s. 6d., and the contents, consisting of envelopes, note-paper, an indelible pencil, four pens and a pen-holder, will be supplied at an additional cost not exceeding sixpence.

EIGHTEENTH ORDINARY MEETING.

Wednesday, April 6, 1859.

The Eighteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 6th inst., Peter Graham, Esq., Member of the Council, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Abinger, Lord
Nissen, Hilary Nicholas
Stevens, James John

The following Institution has been taken into Union since the last announcement :—

Rugby, Institute.

The Paper read was—

ON EMBROIDERY BY MACHINERY.

By George Wallis.

The object of this paper is simply to give a popular description of the leading features of the embroidering machine, and to illustrate its practical use and capabilities by specimens of textile decoration produced by it. A full and complete description of this machine would involve either the presence of a machine in full work, or such a series of elaborate drawings, diagrams, or models, as would render the task of description neither pleasant nor profitable. No attempt, therefore, will be made to do more than simplify the principle upon which the machine is constructed, and give such illustrations of its action and capabilities as may serve to show its superiority over, or indicate its inferiority to, the human hand in the production of embroidered effects. The diagrams used will be such simplifications of construction as will be best calculated to render that construction intelligible, and are in no way intended as illustrations of the complete mechanical structure of the parts described, or of their full action.

As an interesting branch of art-industry, embroidery by machinery is more wondered at than understood, and it is no uncommon thing to find the mechanical agent used in its production confounded with the various sewing machines which have recently come so largely into use for a variety of purposes. Machine embroidery may, as it did some ten or twelve years ago, stimulate the productions of hand embroidery, and, to a certain extent, supplement them, but it is doubtful, to say the least, if it can ever supplant them. Excelling hand embroidery in accuracy of repetition, and in the production of the same design on both sides of the fabric decorated, it is limited in its range, alike as regards subject and the article to which it can be applied.

In variety of effect it can never compete with hand-embroidery, and, although, as in the dress embroidered for Her Majesty, by the late Mr. Louis Schwabe, of Manchester, the effects of the original drawing are given in all their variety, this has only been done at a great sacrifice of all the economic powers of the machine. When Mr. Schwabe first showed me this specimen in 1844, he said, "I was written to and asked if my machines would execute any design? I replied that any design which Her Majesty wished executed should be produced by them. When the drawing came I saw the mistake I had made, but resolved, cost what it might, that the work should be done, and there it is." As an illustration of what can be done by the embroidering machine, the example is interesting, but as an illustration of its economic use, or its superiority over hand embroidery, it is worthless.

Having said thus much as to the true purposes of machinery as applied to embroidery, it may be useful to make a few introductory remarks on the subject of embroidery as an art of so ancient a character, that its origin is entirely lost.

The early history of embroidery is associated with the progress of civilisation and refinement as an elegant employment for females; and one which, from a remote antiquity, exercised a large and abiding influence on ornamental art. It is the most primitive mode of textile decoration, and ranges at once from the simplest figure to the most intricate elaborations of a variety of materials requiring the skill of the needlewoman, with the invention of the ornamentalist. It is practised in one form or another wherever man has made any advance beyond the rude art of ornamenting his body by tatooing. The wonderful embroidery of the Peruvians, which so astonished their Spanish invaders, displayed surprising effects of colour produced by the plumage of tropical birds, combined with threads of gold and silver. In all periods of the world's history, among the richest specimens of ornament dedicated to the service of ceremonial religion, we always find embroidery. In the Mosaic Tabernacle the embroidery of purple, blue, and scarlet was conspicuous, and the elaborate embroidery of sacerdotal vestments, especially those of the high priest, show how largely this sacrificial ornamental work was used in the early ceremonials of the Jews.

In the last chapter of the Proverbs of Solomon is an interesting picture of the virtuous wife, whose "Lamp goeth not out by night," and who "worketh beautiful vestments for herself,"—

> Her clothing is fine linen and purple.
> Her husband is known in the gates,
> When he sitteth among the elders of the land.
> She maketh him fine linen and selleth it;
> And delivereth girdles unto the merchant.
> Verses 22, 23, 24.

In the prophecy, by Ezekiel, embroidery is mentioned as the clothing of Jerusalem, represented under the figure of a woman.

> "I clothed thee also with embroidered work."
> Chap. 16, verse 10.
> "Thou wast decked with gold and silver;
> And thy raiment was of fine linen, and silk, and embroidered work." Verse 13.

The Egyptians used embroidery to a very great extent. The sails of their boats were of embroidered linen, and the wrappings of their dead were frequently thus decorated.

The Greeks attributed the invention to Minerva. Homer describes two of his heroines as engaged in embroidery—Helen, as depicting the combats of the Trojan war, and Andromache,—

> "In the chamber at the palace top,
> A splendid texture wrought on either side,
> All dazzling bright, with flowers of various hues."

The women of Sidon are said to have been noted for their skill in embroidery even before the period of the Trojan war. Pliny attributes its invention to the Phrygians, hence the Roman name for embroidered garments, —*Vestes Phrygionicæ.*

It should be understood, however, that the word signifying "embroidery" is used by ancient writers as a generic term for all kinds of decorative work done by the needle. In later periods, the sense was limited to peculiar effects produced by certain fixed methods, and in more modern times a still greater limit is understood.

The practice of embroidery in Europe was very largely extended during the mediæval periods, and was carried to great perfection for the personal adornment of royalty, the nobility, and especially in the service of the church. The vestments of the priesthood, hangings, veils, canopies, curtains, and other textile articles of use and decoration, were largely embroidered; indeed, the character of the work of this period was chiefly ecclesiastical, and the inmates of convents employed their time in this direction with remarkable results. Some of the most valuable illustrations of the manners and costumes of past ages have come down to us through the agency of the needle; and in proof of this it will be sufficient here to allude to those interesting records in embroidered work and tapestry, as coverings for the walls of rooms, and hangings for doors, windows, and corridors, in the execution of which the ladies of noble families beguiled their leisure hours. Family traditions, historical incidents, portraits, the sports of the field, and groups of natural objects, were all employed in the execution of textile ornaments for the decoration of apartments. In England this art was carried to a high degree of perfection, and in the execution of vestments, English work was so highly prized as to have been constantly sent out to Rome by command of the Pope. There can be little doubt that the skill in embroidered work displayed by our ancestors was the forerunner of several of our most common kinds of ornamentation. Paper hangings for instance, were originally professed imitations of tapestry, the patterns having been first printed on canvas.

Ancient embroidery is divisable into three heads:—"*Low*" embroidery, in which the threads are laid flat on the ground of the work: "*Raised*" embroidery, in which the figures are brought into relief, and rounded by means of wool, cotton, parchment, or paper placed beneath the needle-work: "*Gimped*" embroidery, in which the figures are formed by cords of gold, silver, or silk, and portions of velvet or satin, gold and silk.

Hand embroidery is still extensively practised in the East. The true Indian and Persian scarfs are embroidery work of floss, or untwisted silk, and exceedingly rich effects are thus produced, as will be remembered by those who examined the Indian productions of this class in the Great Exhibition of 1851.

In Turkey and Greece embroidery with gold and silver thread, or richly-coloured cottons, silks, and velvets, is much used for robes and decorations. The embroideries exhibited by Turkey, in the Great Exhibition of 1851, were of a marvellous character in execution, and deserved much more attention than it is to be feared they received. As Commissioner of one of the groups of Juries, I had to direct attention to them, and in the midst of so much that was excellent, the difficulty lay in selecting those most worthy of reward. The articles embroidered were all made up for use as clothing, and the jury for that class had therefore to undertake the work of adjudication. Such was the difficulty of selection, that the task was nearly abandoned in despair, and nothing but an urgent demand on my part that so remarkable a display should have full justice done to it, induced the jury to proceed. From the system adopted by the Turkish authorities in collecting and registering the works, some of the best had to be passed over, and the jury finally reported:—"It is impossible to recognise, either by medal or honourable mention, many of those to whom such distinctions are justly due, as no names are given whereby the jury can take cognizance of the articles. Those cases which the jury have been enabled to recognise are selected as much for the facility for giving such recognition, as for the high merit displayed in the production, inasmuch as there are others deserving of the same consideration, could the jury have discriminated amid the vast collection of articles." The awards are curious, and all to women, except a prize medal to the Tailors' Association of Janina, for Albanian costumes. Whether the daughter of the Turkish gentleman with an unpronounceable name ever received the awarded medal, or the girls Bukudgy and Istche, or the wives of Carabet and Teizy got information of the "honourable mention" made of their embroideries, is a matter of speculation to this hour with those who desired to do them justice.

Probably the finest modern examples of pure embroidery in silk, unmixed with gold and silver thread, pearls or precious stones, are executed by the Chinese. Not only in execution, but in design and the fitness of the forms of the ornament to the material and purpose, the embroideries of the Chinese generally exhibit a great superiority to the usual examples of European skill. The extreme care taken with the work, especially in the more costly specimens, renders them very instructive examples of textile decoration. From 700 to 750 stitches may be counted in the space of a square inch. Some years ago I took the trouble to dissect some of the best examples I could meet with, and the more closely they were examined the more marvellous the work appeared. Some diagrams now before you show the peculiarities of treatment, and illustrate in some degree the arrangement of the stitches.

Of course, the leading Continental nations are producers of embroidery, especially France, but the styles adopted are usually either a reproduction of the ancient methods or imitations of Eastern productions.

This brief sketch of the progress of embroidery by hand, must suffice to introduce the special subject before us,

Embroidery by Machinery.

This has been effected to a considerable extent by the Jacquard and Draw looms, or, rather, effects in imitation of embroidery have been produced. With this, however, we have nothing to do, as machine embroidery, by the legitimate means of the needle, is the point which it is desired to explain and illustrate.

The first idea of the embroidering machine originated with M. Josué Heilmann, of Mulhouse. His object was to combine accuracy of repetition over a large surface with economy of production. Selling it to Messrs. Koechlin, also of Mulhouse, he developed the principle of its construction in their establishment, where it was first practically applied to manufactures. The invention appears to have been first brought before the public in the National Exposition of the Products of Industry, at Paris, in 1834; but the machine was patented for England about 1829, and with all rights, &c., purchased from Messrs. Koechlin by Mr. Henry Houldsworth, of Manchester, by whom it was subsequently very greatly improved from time to time. The first successful use of the machines as improved was in the silk manufactory of the late Mr. Louis Schwabe, in the then Portland-street Mill, Manchester; Mr. Houldsworth having made an arrangement with Mr. Schwabe, as a manufacturer in whose trade their powers would find most development. Here they were employed in embroideries for upholsterers, but chiefly in the "sprigging" of waistcoatings, to which they were peculiarly adapted, as will be shown in the course of the illustrations of the construction and action of the machine.

The leading principle of the machine in the production of a pattern is that of the pantagraph, by which a given form is copied to a fixed scale, in this particular instance to one-sixth the size of the guiding pattern.

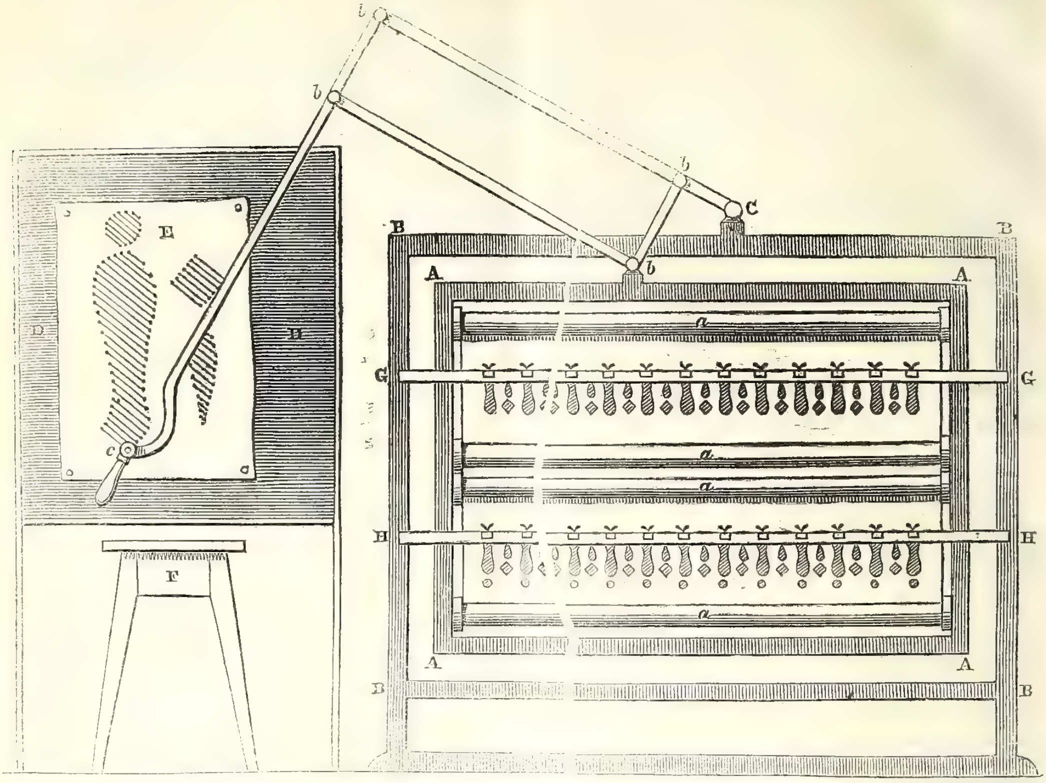
The machine may be divided into *three* parts:—

1. The pantagraph and the embroidery frame, attached upon which the fabric to be embroidered is stretched.
2. The arrangement of the needles and the pincers by which they act on the fabric.
3. The locomotive arrangement of the carriages by which the embroidering threads are carried through the fabric.

The diagrams by which the constructive principle of these several parts will be illustrated are not drawn to any scale or relative proportion, but are simply intended to convey, as far as possible, a distinct idea of the leading features of the machine and its operations, and they have been drawn and arranged with that view only.

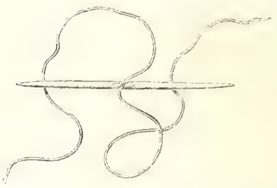
In Fig. 1 we have an elevation of the leading features of the machine, divested of all detail, giving only its essential parts. A, A, A, A, is the embroidery frame, within which the fabric to be embroidered is stretched in

Fig. 1.



two divisions, an upper and lower one, upon rollers *a*, *a*, *a*, *a*. This swings from the outer frame B, B, B, B, at the pivot of the pantagraph C. Every person who understands the action of an ordinary pantagraph, will at once understand that if a figure of suitable design and size is fixed on the vertical plane D, D, as shown in the pattern E, all that will be required in order to copy this pattern to a fixed scale on the plane A, A, A, A, will be to move the pointer c of the lengthened side of the parallelogram *b*, *b*, *b*, *b*, by the handle attached to it. The angles of this parallelogram will become acute or obtuse, just according to the motion required to bring the frame A, A, A, A, into its proper relative position. To effect the copying of the pattern E by a series of stitches, a drawing generally six times the size of the pattern to be embroidered, is made upon a piece of stout paper, or a plate of tin. Each stitch is arranged to this scale, and a hole punched in the paper or plate at each end of every stitch. Into this hole the pointer of the pantagraph is inserted before each stitch is taken. This point is moved backward and forward across the pattern, upon the system of stitches laid down by the embroiderer seated on the stool F; and with each motion the needles are drawn backward and forward through the fabric by a corresponding action of the carriages, on the frames of which the pincers which hold the needles are fixed, as indicated; G to G in the upper tier thus embroidering the upper piece of cloth, and H to H in the lower tier, by which the fabric fixed upon the lower pair of rollers is embroidered. The pattern E is thus repeated one sixth the size, each needle in operation executing a repeat, and the pattern when finished extends the whole width of the fabric at one operation.

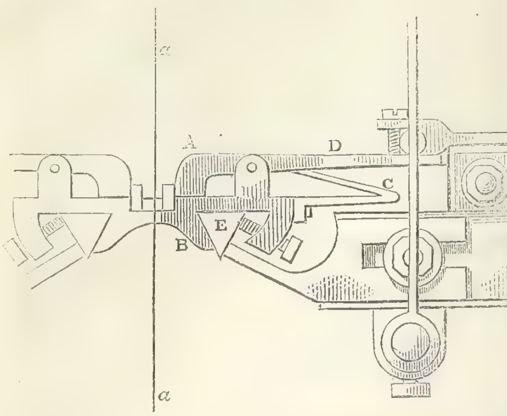
The arrangement of the needles, and the mode by which they are alternately held and released must now be noticed. The needle-holders or pincers act in a manner analogous to the human hands, working from each side of a framework of cloth, placed in a vertical position, the needle being a double-pointed one, with an eye for threading the silk in the middle, thus:—



The pincers are arranged, as already stated, in a double row on two tiers across the frame work of the carriages on each side of the embroidery frame, and project over, so as to come in contact with the fabric when stretched upon it. (See Fig. 3, *a*, *b*, *c*, *d*.) They are placed at one inch and a half from each other, and the larger machines have as many as 75 in each row. The construction of these pincers may be illustrated in profile by Fig. 2.

A is the upper jaw of the pincers, which is kept down upon the needle by the action of a spring,—C. By this spring the upper jaw is brought back into its place after the end has been pressed down at D, to release the needle after it has pierced the fabric, (as shown in section at *aa*,) and been received by the opposite pincer. B is the lower jaw, which is, of course, fixed to the frame. The prismatic rule E runs the whole length of each series or pincers, and sustains them in a perfectly true and corresponding position. The arrangement for the release of the needle after it has been driven through the fabric cannot be easily explained; it must, therefore, suffice to say, that the upper jaw of the pincer is pressed down at the proper time by the action of a rod on the lever end D, and the needle, thus released, after having passed through the fabric, is held fast by the opposite pincer, the thread being thus carried to its full tension, as shown in Fig. 3 at F, and then brought back again to the fabric to be taken up in the same manner by the pincer from which it had been released, again to return at each motion of the pantagraph handle indicating another stitch.

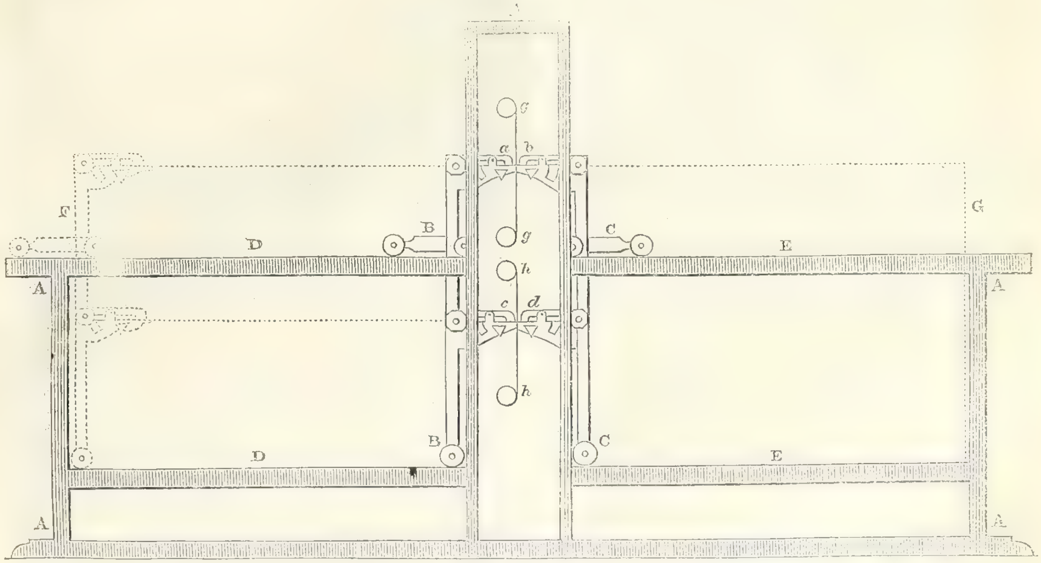
Fig. 2.



Originally this release of the needles depended upon the worker of the pantagraph, who had to use his or her feet upon treadles provided for the purpose, and attached to the releasing rod. One of the improvements effected by Mr. Henry Houldsworth was a mechanical arrangement by which these treadles were dispensed with, and the pantagraph worker, or embroiderer proper, released from the duty of attending to two movements. By this arrangement the releasing rod is acted upon by a clock motion, which is brought into play at the instant the carriage is driven against the frame work when the needle passes through the fabric.

The locomotive arrangement of that portion of the machine which carries the pincers and needles, may be understood in its elementary form by a reference to Fig. 3.

Fig. 3.



A, A, A, A, A, represents the structural framework of the machine, and is of iron; B B and C C the carriages acting on each side of the fabric; *a b* and *c d* indicate the position of the pincers carrying the needles. These carriages run on a species of railway along the horizontal lines D D and E E, and are required to be most accurately fitted. The section of the fabric stretched in a vertical position on the rollers *g g* and *h h*, and passing between the upper and lower tier of pincers, gives the centre line of the diagram.

We will now assume that the needles being threaded and fixed in the pincers *b* and *d*, are pushed through the fabric represented as stretched upon the rollers *g g*, *h h*. The needles are released from *b* and *d*, and seized by the pincers *a* and *c*. The carriage B B is then drawn backward to F, until the threads are all drawn equally through the fabric. The needles being threaded in pairs, that is to say, with a thread of double length, these threads are drawn up to their full tension at once. This supersedes the knotting of the thread to prevent its being drawn through the cloth. The embroiderer sitting at the pantagraph moves the point for the first stitch, as shown in Fig. 1 at E, the carriage B B is brought back to the fabric, and the needles forced through into the jaws of the pincers *b d*, again they are released from *a c*, and being duly fastened upon by *b d*, the carriage C C is drawn along the frame until the thread is again at its full tension, when the carriage reaches G. Stitch the first is then complete.

The pantagraph pointer is again moved for another stitch on the enlarged pattern E, Fig. 1, and again the process of bringing up the needles to the fabric—their passing through—their release on one side and their seizure on the other is repeated, and so the work goes on until fresh needles and thread are required, when the same course is repeated in the putting in, and starting the work at the same point at which the last stitch of the former thread left the work incomplete.

Each machine is usually worked by three young women and three or four girls, the latter being employed to thread the needles and prepare them for the machine, that a supply may be always on hand. One young woman—who is generally the most experienced, and acts as the "captain" of the machine—attends to the pantagraph, criticises the work, and directs the motions of the workers of the carriages, who push backward and forward the rows of needles. With an intelligent "captain," quick and skilful workers, and rapid threaders, an elaborate pattern, and a machine in good working order, I know nothing in manufactures more interesting than the embroidering machine. The pattern grows so rapidly under its action; every stitch tells toward the final effect; and the result is at once so satisfactory, that the operation appears to be the realisation of the thought of the workers direct from their minds, and with no more mechanism than is necessary to realise that thought.

The original machine, as devised by M. Heilmann, was worked by one person, but had this feature been retained the economic value of the invention would have been lessened. It was only by extending the size and capabilities, improving the structure of the parts, without in any way interfering with the principle, which has always been the same, that it could be brought into successful operation as a paying manufacturing agent. In Switzerland the original form is still retained for cotton embroidery, and found to answer for that class of work.

From the time of its first introduction into England, until within the last two or three years, the embroidering machine was employed only by Messrs. James Houldsworth, and Co., of Manchester, as the successors of Mr. Louis Schwabe. A few machines are now used by one or two other persons at Manchester, but the great mass of productions in machine embroidery still emanate from the original proprietors, who have some twenty machines, more or less actively employed.

After the death of Mr. Louis Schwabe, in 1845, these machines were gradually brought to bear upon ladies' dresses, and during 1847 and 1848, at which period I was actively engaged with my friends, the Messrs. Houldsworth, in the development of the capabilities of the machines in this direction, it is not too much to say that the productions of this house, by mechanical means only, did much to foster and keep up the demand for embroidery; and so far from interfering with the hand labour, it is a fact that, in 1849, there were in London alone some 2,000 persons obtaining their living by embroidery who had never done so before, and in Scotland and the north of Ireland some thousands of females were employed in this industry, not in large factories, but in their own houses. The patterns were printed in outline upon the merino or other fabric to be embroidered. These were distributed by travelling agents, and were afterwards collected by them from the workers after the embroidery was finished. As is now generally known, this is the method pursued in Scotland and the north of Ireland in the production of sewed muslins and tambour work.

The advantages of the embroidery machine over hand labour lie chiefly in two points.

1. The rapidity, accuracy, and excellence of work in the production of repetitions of the design in borders, sprigs, flounces, and trimmings for dresses.
2. The perfect embroidery of a pattern on each side of the fabric, as in the case of window curtains, table covers, and trimmings for upholstery purposes.

In the first of these it will be seen that, inasmuch as a needle can be worked at every inch and a half of a machine, and in a double row, there must be great economy in the execution of a pattern arranged so as to repeat at every inch and a half within the vertical range of the embroidering frame, that is to say, within the action of the pantagraph in its command over the rows of needles. The machine is therefore always worked at the greatest advantage when the full range of needles is brought into operation by small repeats, and at the greatest disadvantage when large repeats are worked, and thus a certain number of needles, or rather needle-holders or pincers are idle. Thus, in a pattern which is only repeated at every six inches, three pincers would be idle in every such space in the machine, and my own impression is, that with less than a dozen needles at work, the machine operates at a loss, or at least that there is no gain in the work, except in the matter of a double-sided pattern. The usual calculation is that with less than eight needles the work is executed at a loss.

This is of course one of the disadvantages of the machine in certain classes of the work; and except under certain peculiar arrangements of the design, there was always great difficulty in competing with hand labour, in the execution of the "collonade" fronts of ladies dresses at the period these were in fashion. On the contrary, in bordered and flounced dresses, hand-labour had no chance with the machine.

As may be supposed, these machines presented an apparently insurmountable obstacle in the execution of a series of repeats in a curved line, which a few years ago was one of the problems yet to be solved. Mr. James Houldsworth, the present proprietor, however, has overcome this difficulty in suitable fabrics, by constructing an embroidering frame for insertion into the machine, on which the fabric being stretched upon elastic cross pieces, and screwed up to the desired curvature, the design is embroidered in a right line, but when the fabric regains its original position on removal from the frame, this line becomes a curve, the reverse of the direction in which it was stretched.

Embroidery for dresses being comparatively out of fashion, the machines are chiefly used at the present time for furniture fabrics, such as window curtains, table covers, valences, borderings, and goods for foreign markets, of which there are before you some admirable specimens, all produced by Messrs. James Houldsworth and Co., of Manchester.

Some of the capabilities of the embroidering machine are shown in these examples. The work is clear, fine, and, according to the character of the design, perfect in all its parts, whilst the advantage of having the pattern complete on both sides of the fabric must be apparent to every one, especially in table covers and window curtain borders. Here the peculiar action of the machine in driving the needles through at a perfect right angle, and returning it at the same angle, becomes of great value; not, after all, that the two sides are equally perfect, yet no unpractised eye would easily detect the difference. When, however, the hand embroiderer attempts this kind of effect, the amount of attention required to execute the work, with even a moderate degree of precision, renders the operation anything but an economical one.

An example of work, as applied to linen and cotton fabrics, not previously attempted in these machines, has reached me to-day. When the operation is perfected by the necessary experience, the result will no doubt be satisfactory, as the style of embroidery is well adapted to a great variety of articles in ladies' dress.

In the matter of design as applied to machine embroidery it must be evident that there are certain peculiarities about it which the artist, to be successful, must thoroughly understand.

The repeats of the pattern must all be either one inch and a half wide, or multiples of that width; that is to say, three, four and a half, or six inches, and so on. The vertical range may be said to be unlimited, except by economy of production; for, by means of the rollers on which the fabric is placed, the work can be carried even into stripes, as, indeed, has been done when necessary. In making a working design, the length of stitch has to be carefully kept in view, and the angle at which the thread will lie when the work is seen as a whole. In hand-embroidery this is also a condition, but in that great masses of these stitches may be brought together, which is a peculiarity of Eastern embroidery, and the effect produced by the contrasting angles at which the thread is inserted is often very remarkable, especially when different shades of the same tint or colour have been employed. In machine embroidery this kind of effect cannot be imitated successfully or economically, and it is usual to keep each form as much as possible to one, or, at most, two series of stitches. Shaded effects, however, are produced, as in the case of the dress embroidered for Her Majesty the

Queen, by dyeing the silk with a graduated tint or shade, by which the thread is dark at one end and gradually becomes light at the other end. Pleasing effects are thus produced in a very economical manner, even in what are called self-coloured embroideries—say, on dark green merino, embroidered with silk shaded from dark to light green. These irregular effects of light and shadow are not, however, very legitimate when viewed artistically; but for this the manufacturer cares quite as little as the consumer. If the things sells with the one and "looks pretty" to the other, that is enough, according to the art-creed of both.

There is yet another point which in the smaller patterns it is of considerable importance for the designer to bear in mind. Silk at 40s. per lb. is too costly to be wasted, therefore it is desirable that each needleful should do its work, and that no fragments should remain to cut away at a loss. Hence patterns have to be designed to the needleful; and, if a pattern, however excellent in the abstract it may be, consumed one needleful and 36 inches out of two needlefuls of 42 inches each, it would be considered anything but sound economy in machine embroidery to execute it, as eight inches of silk would be lost in each needle employed—a waste upon any extent of production which would astonish those who are not in the habit of thinking about mere fragments in the materials of manufacture. It will at once be seen from this fact that the designs for machine embroidery must ever be somewhat peculiar, and, to a certain extent, limited in range of form, and that all the more successful—certainly the most economical—are made almost in the presence of the machine by which they are to be executed, and, for the most part, under no higher inspiration than that of a species of artistic measure table, such as:—

Two needlefuls make one flower.
Three flowers make one repeat.
Twenty repeats make one border.
Four borders make one table cover decoration.

One can thus tell almost to an inch—certainly to a yard—how much silk will be consumed in a given operation.

It will now be asked, "Do these machines begin and finish their work completely?" Not absolutely; but so perfect is the work in a well-arranged pattern that, with the exception of the cutting out of certain ends used for starting points, the occasional fastening of other ends, and the insertion here and there of a stitch by hand, the work is practically finished when it leaves the machine. Experienced hand embroiderers, acquainted with the peculiarities of machine work, are, however, employed to look it over.

As a branch of factory labour for females, none is so healthy, certainly none more interesting.

The workers are generally the most intelligent of their class, and their wages are fully remunerative when work is abundant; but there is one great drawback in the economical working of these machines, in contradistinction to that of most other manufacturing agents. The fashion for embroidery fluctuates very much. In times of increased demand there is great anxiety and much trouble in instructing even the generally intelligent girls who are desirous to get this kind of employment.

A sudden change of fashion throws the machines out of work, and with it the workers, and when a demand again occurs, fresh hands have to be instructed. Happily, there is less change in furniture fabrics than in dresses, and thus the best hands are retained ready for an emergency and the instruction of others; but the operative classes are now keenly alive to the disagreeable character of fluctuating employments, alike to employer and employed; and thus the difficulty is increased even to such a house as that of the proprietors of these machines, whose reputation as employers of factory hands has always stood so high.

In concluding this attempt to explain the mechanical principle and economic application of one of the most interesting agents which, in the progress of modern invention, has been brought to bear upon textile decoration, it is only right to state that the imperfections of the exposition are inherent in the subject, and nothing but a very earnest desire to comply with the wishes of the managing officers of the Society of Arts, that a popular explanation of the construction and peculiarities of the embroidering machine should be given to the members, would have induced me to undertake the task, under the many disadvantages which must necessarily arise out of the fact that my connection with these machines, in a practical form, ceased ten years ago, and I doubt if I have seen them more than three times in the interval.

DISCUSSION.

Mr. **Frederick Lawrence** inquired whether different coloured silks or threads were worked in the machine at the same time.

Mr. **Wallis** replied that in producing chintz effects, as many colours as might be necessary could be used in different needles, but in getting the shaded effects, as shown in some of the examples, the "trick," for such it really was, of shading the silk in dyeing from light to dark had to be adopted; and thus a certain variety of effect was produced, although this was not always of a very artistic character.

Mr. **William Hawes** said, looking at this paper, not with the eye of a manufacturer, because he had no knowledge to enable him to form an opinion upon the subject, but as being very interesting in a social point of view, he would offer a few remarks upon one or two matters connected with the subject. The first point which struck him, was that this invention afforded employment to women. It was that peculiar kind of occupation which, whilst stimulating taste, was capable of becoming a domestic manufacture, and was, therefore, of the greatest benefit to that class which stood most in need of employment. This machine appeared to effect the important end of the economical working of a costly material; for they understood from Mr. Wallis that they could measure, almost to the fractional part of an ounce, the quantity of silk necessary to produce a certain amount of embroidery; and, when that fact was known, all temptation to fraud on the part of the workpeople ceased; whereas, in times past, when the silk machines were employed in the houses of the workers, they became a source of constant collision between the employers and the employed, in accounting for the material entrusted to them for the purposes of manufacture. If this machine was capable of doing certain descriptions of embroidery, as well as, or better than, hand labour, and employed persons for whom employment was required, and at the same time allowed the manufacturer to entrust a valuable commodity in the hands of the work-people, without fear of fraud—on all those grounds it must be regarded as a valuable addition to our mechanical resources. They had been told that the machine was not, in all cases, capable of producing such perfect results as were obtained by hand labour; but they were likewise told that for some descriptions of goods it produced a better and cheaper article than hand labour could supply. These were points which he thought were especially deserving the attention of the Society; and he considered that they were very much indebted to Mr. Wallis for the clear manner in which he had put before them the benefits which manufacturers and the public might derive from machines of this kind.

Mr. **David Chadwick** said, although not connected with this branch of manufacture, he wished to call the attention of Mr. Wallis to an omission in his paper. He did not hear that any mention was made of a gentleman in Lancashire who had devoted a great deal of attention to embroidery—Mr. Gilbert French, of Bolton. He had visited the works of that gentleman, and had noticed the large number of females who were employed upon this beautiful work, and he had seen specimens of embroidery which, to his eye, were more beautiful and elaborate than those exhibited that evening. Although, as a Manchester man, he felt proud of the honourable mention that had been made of Mr. Houldsworth, yet he thought it would have been well if Mr. Wallis had brought forward some specimens of hand labour in this branch of art, produced by first-class workers of the present day, so as to compare them with the best productions of machine embroidery. As one of the public he thought Mr. Wallis's paper was somewhat defective in some portion of its statistics. He had given them minute particulars of the process by which the work was effected, but he had not given any comparison of the cost of producing these beautiful articles by machinery as compared with that of hand labour. To the public generally it was a matter of little importance by what means a particular article was produced; they were only interested in the economy of the production. Those who purchased these fabrics were astonished at the price at which beautiful table covers could now be obtained, as compared with the cost of similar articles ten or fifteen years ago. He should be glad to hear from Mr. Wallis, if he was able to furnish it, a comparative statement of the cost of producing these articles by hand labour and by machinery. During his (Mr. Chadwick's) visit to Mr. French's establishment, he was informed that that gentleman supplied hand-worked patterns of embroidery of the most costly description, not only to every part of England, but almost to every part of Europe, and that he found, notwithstanding the increasing production of machinery, the demand for hand embroidery work had been constantly advancing.

Mr. **Wallis** said he feared that Mr. Hawes had misunderstood his remarks as to the increase of domestic employment occasioned by the stimulated production of embroidery in 1847-8. The machines could never be brought into use in the houses of the workers like the sewing machines, as they were of too cumbrous and costly a character. All that was meant in this direction was to call attention to the fact that the demand for hand labour was increased by the action of the machines in cheapening production and thus stimulating demand.

Mr. **Hawes** said he had merely quoted from the paper itself, which stated, "so far from interfering with the hand labour, it is a fact that, in 1849, there were in London alone some 2,000 persons obtaining their living from embroidery who had never done so before, and in Scotland and the north of Ireland some thousands of females were employed in this industry, not in large factories, but in their own houses."

Mr. **Wallis** continued—With respect to Mr. D. Chadwick's remarks, it happened that Mr. Chadwick was a statist, and he (Mr. Wallis) an artist; both studied figures, but they were of a different kind. He had great respect for figures in arithmetic, and no doubt it would have added to any value there might be in his paper if some comparative statement could have been made as to the cost of production in certain classes of work by machine and hand embroidery. It happened, however, that one or two articles would be no test whatever for any other article, as each would have to be judged of by the quantity of work in each under the precise conditions of its production, for, as shown in the paper, economy in machine embroidery depended upon the greatest use of the needles, and adaptation of the pattern to length of thread, etc. With respect to the excellent productions of Mr. Gilbert French, of Bolton, he (Mr. Wallis) thought he had carefully guarded himself from misapprehension when he stated that his subject was commercial and not artistic embroidery; besides, he had illustrated by a reference to certain examples, the fact that the machine could not produce large and massive patterns of an exceptional character with the same economy as small repeats; nor did he believe that on the whole the larger works would possess the artistic qualities of good hand embroidery. His object had not been comparison, but a simple statement of what the embroidery machines could do.

Mr. G. F. **Wilson**, F.R.S., said there was one point of great interest mentioned in the paper, which had a particular bearing upon the matter which they were all so anxiously discussing—namely, the great Exhibition of 1861. It had been shown that this machine had been first brought out at the national exposition of products at Paris, which was another fact added to the many that had already appeared in the *Journal* of the Society in connection with exhibitions.

The **Chairman** remarked that it would be clear to all present that when Mr. Wallis undertook to read this paper he entered upon a difficulty. When he (the Chairman) first heard the announcement of this paper, he could not conceive how Mr. Wallis could make them comprehend the subject without a machine to illustrate it. But they must all admit that he had explained it well, and that they now really understood how embroidery by machine was accomplished. With regard to the statistics of economy by this process, which had been asked for by Mr. Chadwick, they would understand that in a certain class of goods the economy was twenty times as great as in others. Some of these machines would carry 100 of these needles in one length, and work two frames at the same time—working 200 needles in a simultaneous operation. It appeared that a machine of this description required the attendance of one person to work the pantagraph point, four girls to move the frame, and three others to thread the needles. Thus, they had 200 needles at work with the labour of eight persons, which made a proportion of 25 needles to 1. In some cases there would be no economy at all in the use of the machines; but it was in such articles as table covers, and embroidered cloths that the economy of the machines was most apparent. In the embroidery of one of the table covers exhibited, they would probably have two rows of 96 needles each at work, and from the length of the frame they could work two covers at once; and at the same time the manufacturer had the satisfaction of knowing that he could not be robbed of his silk, as they could calculate almost to a drachm what quantity of silk was consumed in working a particular pattern. Mr. Wallis did not go quite far enough back in his history of the use of these machines. He (the Chairman) remembered that about the year 1834, Mr. Schwabe undertook a very large contract from a city house for embroidered merino dresses; he believed that was the occasion of the first introduction of machine embroidery for ladies' dresses. He might observe that since sewing machines were introduced they had heard very little about distressed needlewomen, and it was evident that the introduction of the embroidery machine had greatly increased the demand for that branch of labour. Machine labour and hand labour acted and re-acted upon each other, the one creating a demand for the other. He had now to propose that which he was sure would be passed with acclamation, namely, a vote of thanks to Mr. Wallis for his interesting paper.

The vote of thanks having been passed,

Mr. **Wallis** briefly acknowledged the compliment.

The Paper was illustrated by a large number of fine specimens of machine embroidery, lent by Messrs. Houldsworth and Co,, of Manchester, as well as by several working diagrams prepared by Mr. Wallis. Messrs. Wilson and Newton exhibited their Boudoir Sewing Machine.

The Secretary called attention to an instrument, invented by the Rev. W. Taylor, for enabling the blind to work sums in arithmetic, and solve algebraical problems. A description of the instrument will be found at page 328 of the *Journal.*

The Secretary announced that on Wednesday evening next, the 13th inst., a Paper by Mr. H. Hyde, "On Professor Hughes's System of Type-printing Telegraphs and Methods of Insulation, with Special Reference to Submarine Cables," would be read.

SCHOOLS IN SAXE COBURG.

Persons connected with education in this country will probably peruse with some degree of interest the plans of teaching adopted at two Institutions of different character in the Duchy of Saxe Coburg—the Gymnasium Casimirianum, a learned school, at which the study of the ancient languages holds a prominent place, and the "Real-Schule," or School of Practical Utility, where more attention is paid to natural science, the study of Greek being omitted altogether. An outline of the plan pursued at a third Institution, the Ducal Gymnasium ,is likewise before us, but, in principle, it so closely resembles that of the "Real-Schule," that particular description would be superfluous.

Those who are not familiar with the scholastic language of Germany should be informed that the lower numbers designate the higher classes, so that the "prima," or first, is the highest, except where, as in the case of the Gymnasium Casimirianum, there is a "selecta," or select class, even above the "prima." The hours set against each department of study are obviously per week. The names at the head of each class are those of the professors or teachers in ordinary, but these do not give instruction in all the departments of study pursued by their several classes; nor is each confined exclusively to his own.

Plan of Instruction adopted at the Gymnasium Casimirianum for the Scholastic year beginning at Easter, 1853, *and ending at Easter*, 1854:

Selecta.—(Six Pupils.)—Director Forberg.

Religion.—Two hours, in conjunction with the Prima.—In summer, an exposition of the Life of Christ, according to the Four Gospels. This is combined with an explanation of several passages of scripture (especially from the fourth gospel), bearing reference to the *person* of Christ. In the winter, an explanation of the Acts of the Apostles and the Epistle to the Romans.

Latin.—Seven hours.—A selection from the Odes and Episodes of Horace; a selection from Cicero's Epistles: the Annals of Tacitus, books iv., v., vi., xi.; free Latin compositions, one every month; written and oral translation, after Nägelsbach's Exercises in Latin style.

Greek.—Ten hours.—Plato's "Menexenus, Apology of Socrates and Phædo, in connection with written exercises after Rost and Wüstemann's "Introduction to Translation; the "Ajax" and "Œdipus of Sophocles.

Hebrew.—Two hours.—Grammar, after Gesenius (the declension of nouns); the first eight chapters of the Book of Judges; exercises in reading the text without points.

German.—Four hours.—Essays and discussions; explanation of some of Goethe's Lyrical Poems; Goethe's "Iphigenie" and Schiller's "Don Carlos."

French.—Two hours.—"Le Malade Imaginaire" and "Les Femmes Savantes" of Molière. Oral translation from Lessing's "Minna von Barnhelm," and "Emilia Galotti." Written translation from Grube's "Reisebilder," and the second part of Hermann Müller's Grammar.

English.—Two hours.—Selections from Washington Irving's "Sketch-book;" Byron's "Mazeppa" and "Siege of Corinth;" repetition of Syntax after Wahlert, with weekly exercises in composition.

History.—Two hours.—The Middle Ages, from the commencement to the Reformation.

Mathematics.—Three hours.—Combination, elements of the calculation of Probabilities; Binomial Theorem; Quadratic Equations, with several unknown quantities; solid Geometry; exercises.

Physical Science.—Two hours.—Geo. Statics and Geo Dynamics. Mathematical Geography.

Drawing.—Two hours.—In conjunction with the Prima.

Singing.—One hour.—In conjunction with the Prima.

Prima.—(Twelve Pupils.)—Professor Trompheller.

Religion.—Two hours —In conjunction with the Selecta.

Latin.—Seven hours.—The "Catilina" and "Jugurtha" of Sallust; the "Andria" and "Adelphi" of Terence; Cicero's Oration against Cæcilius (Divinatio), and Verres (book iv.). Latin Exercises from Süpfle; (Aufgaben).

Greek.—Five hours.—Homer's "Iliad," lib. xxi. to xxiv. Select Idylls from Theocritus, Bion and Moschus; Herodotus, Lib. viii., 1—183; Greek Syntax after Krüger, with exercises after Rost and Wüstemann's "Introduction."

Hebrew.—Two hours.—Grammar after Gesenius; the Verb; Extracts from Maurer's "Elementarbuch;" the Prophet Jonas; First Book of Kings, chap. 1.

German.—Three hours.—Examination of weekly and monthly exercises. Explanation of a selection of poems from Echtermeyer and Hiecke's Anthology (Blumenlese), and of the "Götz von Berlichingen," of Goethe.

French.—Two hours.—Ségur's "Histoire de Napoléon et de la Grande Armée." Oral translation from Schiller's "Neffe als Onkel" and "Parasit." Written exercises after Müller's Grammar.

English.—Two hours.—Washington Irving's "Life of Columbus," Conjugations, Syntax, and Exercises after Wahlert.

History.—Two hours.—Ancient History.

Mathematics.—Three hours.—Systems of Notation, Evolution, Quadratic Equations, with one unknown quantity, Involution, Logarithms, Progressions, with application to interest and annuities; Plane Geometry concluded; Solid Geometry commenced.

Physical Science.—Two hours.—Mechanical and Chemical Phenomena.

Drawing.—Two hours.—In conjunction with the Selecta.

Singing.—One hour.—In conjunction with the Selecta.

Secunda.—(Thirteen Pupils.)—Prof. Dr. Kern.

Religion.—Two hours.—Explanation of select passages of Scripture. Repetition of the Lutheran Catechism.

Latin.—Two hours.—Ovid's Metamorphoses, Lib. ii. iii. iv. (with omissions). Cæsar, Bellum Civile, Lib. ii. iii. Grammar after Zumpt, and Exercises after Süpfle.

Greek.—Six hours.—Homer's Iliad, Lib. vii. viii. ix. Lucian's "Dialogi Deorum," "Dialogi Marini," and "Cataplus." Declensions and Conjugations after Krüger, with weekly exercises after Rost and Wüstemann.

German.—Three hours.—Reading and explanation of specimens from Mager's "German Reader" (*Deutsches Lesebuch*). Exercises in oral delivery and essays.

French.—Two hours.—Reading from Gruner's "Chrestomathie." Weekly exercises and explanation of the first part of Herman Müller's Grammar.

History.—Two hours.—The Ancients and the Middle Ages.

Geography.—Two hours.—Australia and Europe, omitting the Balkan Island.

Mathematics.—Three hours.—Elements of integral and fractional Arithmetic and Algebra, Simple Equations, Proportion, and Rectilinear Geometry, complete. Exercises.

Natural History.—One hour.—In Summer: Botany—the plants being classified according to Linnæus. In Winter—the second part of the introductory course in Physics.

Drawing.—Two hours.—After Copies and Nature.

Caligraphy.—Two hours.

Singing.—One hour.

Tertia.—Teacher in Ordinary, Mather. (Nine Pupils.)

Religion.—Two hours.—Exposition of the Lutheran Catechism.

Latin.—Seven hours.—Reading of Döring's Elements, and select Biographies of Cornelius Nepos; Grammar and Exercises.

Greek.—Five hours.—Declensions and Conjugations as far as the contracted Verbs. Translations from Jacob's Elements and Weekly Exercises.

German.—Three hours.—Explanations of specimens of prose and verse from Gude's "Reader." Essays and practice in Declamation and Narration.

French.—Two hours.—Reading of Gruner's "Chrestomathie." H. Müller's Grammar, Exercises.

History.—Two hours.—Repetition of the course of the previous year, German history from the time of the Hohenstauffen.

Geography.—Two hours.—Repetition of the course of the previous year, also Africa, Asia, Australia, and a part of Europe.

Natural History.—Two hours.—In Summer, description and definition of plants, with the characteristics of the more important families. In Winter, Zoology (Mammalia, with especial reference to man).

Mathematics.—Three hours.—Commercial Arithmetic, decimal fractions, extraction of the square root, simple equations, lines and angles.

Drawing.—Two hours.

Caligraphy.—Two hours—
Singing.—One hour— } in conjunction with Quarta.

Quarta, Teacher in Ordinary, Dressel. (Twenty-four Pupils.)

(The pupils in this class, united in other respects, are divided into two sections, according to their proficiency in Latin, and French is learned in the upper section only).

A.—The Entire Class.

Religion.—Three hours.—Completion and repetition of Old Testament History; followed by New Testament History.

German.—Three hours.—Gude and Gittermann's "Reader;" explanation of poems, essays, practice in narration and declamation.

History.—Two hours.—Repetition of ancient history. Epoch—marking events in German history, till the time of Frederick the Great.

Geography.—Two hours.—General introduction; the world, with the exclusion of Europe.

Natural History.—Two hours.—General view of the vertebrated animals; the mammalia by way of repetition; birds.

Drawing.—Two hours.

Caligraphy.—Two hours—
Singing.—One hour— } in conjunction with Tertia.

B.—Upper Section of Quarta.

Latin.—Grammar after Kühner's Elements; translation after Döring's Elements; exercises.

French.—Two hours.—Reading of Voigtmann's French Elements; H. Müller's Grammar, with oral and written translations of the exercises which it contains.

C.—Lower Section of Quarta.

Latin.—Five hours.—Declension and conjugation; translation from Bagge's Introduction (Vorschule); exercises.

Plan of Instruction adopted by the "Real-Schule" for the Scholastic Year, 1857-8.

Class I.—(Nine Pupils.)

Teacher, the Director, Dr. Ernst Friederich Eberhard.

Religion.—Two hours.—Introduction to the Old an New Testaments: Epistle to the Romans; History f the Christian Church.

German.—Three hours.—Reading and exposition of Göthe's "Egmont," and of the "Antigone" of Sophocles (in German). History of Literature—Improvement of Style with regard to Domestic Affairs—Extemporary Speaking and Discussion.

English.—Three hours.—Byron's "Mazeppa;" Macaulay's "History of England;" exercises in writing and speaking.

French.—Three hours.—The "Lucrèce" of Ponsard; Poems of Béranger; writing and speaking.

Latin.—Three hours.—"Livy;" exercises in composition.

Mathematics.—Six hours.—Modern Geometry; higher branches of Trigonometry; solid Geometry and Projection—continued Fractions; Diophantine analysis; Series, with their application—Binomial Theorem, Calculation of Probabilities; Cubic Equations.

Physical Science.—Five hours.—The Doctrine of Imponderable Substances; Structure of the World.

Chemistry.—Three hours.—Repetition of Organic Chemistry; Elements of Organic Chemistry; Qualitative Analysis; exercises in Manipulation.

Geography.—Two hours.—Special study of Europe.

History.—Two hours.—Modern times, from the Reformation to 1740.

Drawing.—Two to four hours.

Singing.—Two hours.

Gymnastics.

Class II.—(Thirteen Pupils.)

Teacher, Schlegel.

Religion.—Two hours.—Reading of the Psalms, and some of the Prophets, and one of St. Paul's Epistles; Church History.

German.—Three hours.—Reading of Schiller's "Braut von Messina;" Review of the different kinds of poetry, particularly the Epic; and illustrative reading.

English. — Three hours. — Washington Irving's "Sketch Book," alternately with Gantter's "Chrestomathie; Exercises in writing and spelling.

French.—Three hours.—The "Avare" of Molière; Ségur's "History of 1812;" exercises in spelling and writing.

Latin.—Three hours.—Cæsar "De Bell. Gall.;" composition.

Mathematics.—Six hours.—First course of Geometry; Geometrical Problems; Plane Trigonometry; general Arithmetic; Simple Equations, with one or more Unknown Quantities; Powers, Roots, Logarithms; Compound Interest.

Physical Science.—Three hours.—Doctrine of Imponderable Substances.

Chemistry. — Three hours. — Metalloids and Light Metals.

Natural History.—Two hours.—Botany; Systematic Classification of Plants; Morphology. In winter, Zoology.

Geography.—Two hours.—Special Study of Europe.

History.—Two hours.—The Middle Ages:—Drawing, Singing, Gymnastics, as above.

Class III., Upper Division.—(Twenty-eight Pupils.)

Teacher, A. Mueller.

Religion.—Two hours.—The Gospel of St. John, and the Acts of the Apostles; the fourth and fifth sections of the Catechism.

German.—Four hours.—Explanation of selections from Nacke and Lüben's "Reader;" exercises in speaking and writing.

English.—Three hours.—Reading of Gantter's "Chrestomathie; oral and written exercises after Voigtmann's Elements.

French.—Three hours.—Gruner and Wildermuth's "Chrestomathie;" exercises in speaking and writing.

Latin.—Three hours.

Mathematics.—Six hours.—Second course of Plane Geometry. Arithmetic—repetition of preceding course; Extraction of Roots; Single Equations, with one unknown quantity.

Natural Science.—Two hours.—Elements.

Natural History.—Two hours.—Botany: Classification and description of Native Flora; characteristics of the more important families of plants.

Geography.—Two hours.—Europe, especially Germany.

History.—Two hours.—The Ancients.

Caligraphy.—Two hours.

Drawing, *Singing*, and *Gymnastics*, as above.

Class III. Lower Division. (Fifty-three Pupils.)

Teacher, Schindhelm.

Religion.—Two hours.—Scriptural reading; the third section of the Catechism.

German.—Four hours.—Mager's Reader; exercises in writing.

English.—Three hours.—Gräser's "Clue" (Leitfaden).

French.—Four hours.—Exercises in speaking and writing, accompanied by Plötz's course.

Latin.—Three hours.

Arithmetic.—Four hours.—Commercial Arithmetic.

Geometry.—Three hours.—First course.

Natural History.—Morphology; Description and Classification of the Native Flora. In the Winter, Zoology.

Geography.—Two hours.—The quarters of the Globe, especially Europe.

History.—Two hours.—Germany.

Writing.—Two hours.

Drawing, *Singing*, and *Gymnastics*, as above.

Class IV.—(Forty-seven Pupils.)

Teacher, Zizmann.

Religion.—Three hours.—Second Section of Catechism. Reading of New Testament.

German.—Four hours.—Mager's "Reader." Exercises in Writing.

Latin.—Four hours.

French. — Four hours. — Plötz's "Compendium" (Lehrbuch).

Arithmetic.— Four hours. — Fractions; Introduction to Mercantile Arithmetic; Rule of Three.

Natural History.—Two hours.—Description of several native plants and animals.

Geography.—Two hours.—Germany.

History.—Two hours.—The times after Charlemagne.

Singing.—Two hours.

Writing.—Three hours.

Drawing (after nature and geometrical).—Two hours.

Gymnastics.

Class V.—(Fifty Pupils.)

Teacher, Hœfer.

Religion.—Three hours.—The Decalogue.

German. — Four hours. — Exercises in writing and speaking.

French.—Five hours.—After Plötz's "Compendium."

Arithmetic.—Five hours.—Fractions.

Natural History.—Two hours.

Geography.—Two hours.—General introduction and use of the globes.

History.—Two hours.—The Ancients.

Writing, *Drawing*, *Singing*, as in Class IV.

Class VI.—(Thirty-eight Pupils.)

Teacher, A. Krauss.

Religion.—Three hours.—Biblical narrations from the Old and New Testaments; Texts; Hymns; the Decalogue, without Luther's explanation.

German.—Two hours.—Explanation of short passages of Scripture. Exercises in Writing and Orthography.

Arithmetic.—Six hours.—The Four Rules, with Concrete Numbers.

History.—Two hours.—The most important events of different Times and Nations, taught biographically.

Geography.—Two hours.—The principal Mountains, Rivers, and Cities of Germany.

Natural History.—Two hours.—Description of the commonest Domestic Animals.

Writing.—Four hours.

Singing.—Two hours.

Drawing.—Two hours.

Gymnastics.

Class VII.—(Thirty-Nine Pupils.)

Teacher, Hauch.

Scripture History.—Five hours.—Narratives from the Old and New Testaments; easy Texts and Hymn-verses committed to memory.

German.—Six hours.—Reduction of Sentences to Words; of Words to Syllables; and of Syllables to Simple Sounds; the Parts of Speech; Exercises in the narration of short, simple Tales; Orthographical Exercises.

Reading.—Four hours.—Tales and Poems from Ludwig and Heinisch's "Reader," suited to the capacity of children, read and explained; Simple Poems committed to memory.

Arithmetic.—Six hours.—The four rules, with abstract numbers.

Natural history.—Two hours.—In the Summer several native plants described and compared; in the Winter several beasts, birds, amphibious animals, fishes and insects.

Geography.—Two hours.—First Notions, as, for instance, the elevation and depression of the earth. The Saxon duchies passed in review.

Writing.—Three hours.

Class VIII.—(Twenty-seven Pupils).

Teacher, J. K. Pechtold.

Religion.—Two hours.—Suitable narratives from the Old Testament, with appropriate texts and verses.

German.—Six hours.—Reading exercises in German and Roman letter, orthography, short essays, and composition.

Arithmetic.—Four hours.—Numeration from 10 to 100.

Geography, by actual inspection.—Two hours.—The City of Coburg and its nearest environs; observation of the most ordinary natural phenomena.

Natural history by actual inspection.—Two hours.—Description of bodies ordinarily met with by children.

Writing.—Two hours.

Class IX.—(Twenty Pupils.)

Religion.—Two hours.—Tales to awaken religious and moral feelings.

German.—Four hours.—Reading, writing, and speaking.

Arithmetic.—Numeration of the first ten numbers.

Instruction by actual inspection.—The School and the Home.

HALF-TIME SYSTEM OF EDUCATION.

The following is an abstract of a Paper read by C. Paget, Esq., M.P., at the Liverpool Meeting of the Association of Social Science:—

Having seen the advantage of the Half-time System of Factory Education, it occurred to me that the same principle might be introduced into rural districts.

In November, 1854, I employed eight boys on my farm, to do the work formerly performed by four, each boy spending half his day at work, and half at school—relieving each other, so that I should always have four on the farm and four at school. I found an inconvenience in this arrangement; when the boys' clothes were wet and dirty, from their morning's work, they were unfit for school. The boys, therefore, now work on alternate days.

After four years' experience, as an employer of labour, I have every reason to be satisfied with this system.

The boys, having an alternate day of rest, work with more pleasure and spirit; and I find as many willing to accept employment as I want. The parent, who might feel the entire loss of his son's wages to be too great a sacrifice is willing to forego one-half to secure an education which does not interfere with the acquisition of the knowledge essential to his power of maintaining himself at an early age.

The children are never weary of school or work. Their progress is very nearly equal to that of those whose sole business is attending school.

At fourteen years they have acquired the rudiments of school-learning, a knowledge of the business of life, and enter into service with all that skill combined with hardihood which the farmer who hires them has a right to expect. They are much better servants than mere schoolboys.

Their school life being compared, not with a holiday, but with a day of labour, they look upon it as a rest; and their associations with books are not irksome, but agreeable, so that they retain what they have acquired. They attend regularly, and, remaining to a later age, their attainments are higher, and they give a higher tone to the school.

Mr. Spencer, the master of our Free School, declares that any master who has experienced the benefits of the system will be very unwilling to forego them.

In October, 1858, I examined three of the boys now on my farm, who have been upon this system a considerable time, and who are about to leave school; two being thirteen, and one just 14 years of age. They all read intelligently and well. They wrote from dictation, from a book not previously seen, in a clear hand and with few mistakes.

I found them quite familiar with the first four rules of arithmetic, and reduction and compound multiplication.

The labouring classes voluntarily adopt this system in their own arrangements. In addition to sixteen, who are working as pairs in agricultural labour, there are several pairs employed in the winding and seaming, belonging to the stocking manufactory, and several girls, who assist the mother in her domestic duties alternately; and in both these cases the system works very satisfactorily.

Where, in close parishes, the possessors of estates compel the labourers to live in adjoining villages, in order that they may keep down their poor rates, there may be difficulty in providing pairs in sufficient number for the farmers; but this evil, arising from the law of rating, must ere long attract the attention of the legislature.

This alternate system of labour and rest appears to be natural, the activity of the body is a good preparation for the activity of the mind.

The principle admits of a very wide application. Already a manufacturer in Nottingham has adopted it with satisfactory results to forty boys in his employ; and I believe that our middle classes might give their sons, up to the age of 20, an alternation of a day of college and gymnastic exercises, with a day in the counting house; and thus confer upon them that inestimable boon, a sound mind in a healthy frame.

TANGIBLE ARITHMETIC FOR THE BLIND.

The following is the description of an apparatus contrived by the Rev. William Taylor, F.R.S., by the aid of which blind persons may be enabled to solve questions in common arithmetic, and also in Algebra:—

Fig. 1.

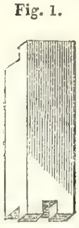


Fig. 2.

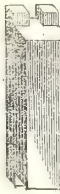


Fig. 3.

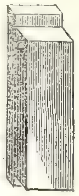


Fig. 4.

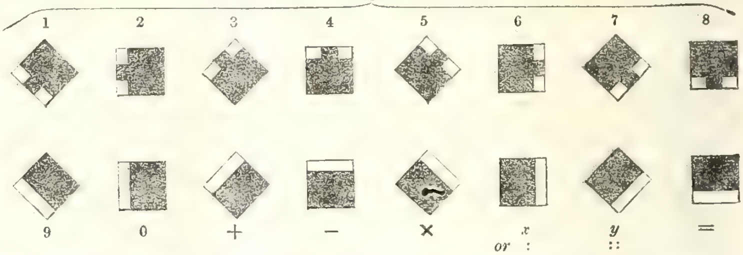
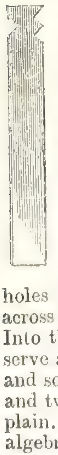


Fig. 5.



The contrivance consists of a sort of board of gutta percha, half an inch thick and of any convenient size, the smallest being three inches and a half wide and seven long. It contains 128 octagonal holes, into which square pegs are to be placed to represent numbers, &c. The pegs are one-sixth of an inch square and three-eighths of an inch long. At one end there are two small projections about one-tenth of an inch high; at the other end one projection continues the whole width of the peg. These serve to show which end of the peg is uppermost, and its position in the hole. Fig. 1 represents the peg; figs. 2 and 3 the different ends; fig. 4 shows the sixteen positions of the peg in the holes. Between the holes there are saw-cuts (one-eighth of an inch deep) across the board, dividing it into as many squares. Into these saw cuts small strips of tin are inserted, to serve as *lines* or *vincula*. They are of various lengths, and some of them have a notch near the end, on one side, and two notches on the other, as in fig. 5, and some are plain. When these tins are placed over one or more algebraical quantities, with the single notch to the left-hand, it represents the *square root* of those quantities, and when the notch is to the right-hand, the *square* of them. The *cube* and its *root* are similarly indicated by the *double notch*. Other tins with different notches may serve for other powers and roots. The plain or unnotched tins serve to separate fractions, &c., and for lines in common arithmetic between sums and their answers. When several pegs are placed in adjacent holes, from left to right, the one on the right represents *units*; the next towards the left *tens*; the next, *hundreds*, &c. To represent any number, place a peg in one of the holes, in the position indicated by that number in fig. 4. Should the number consist of two or more figures, two or more pegs must be placed in as many adjacent holes, and in the positions represented by those figures in fig. 4. If a fraction be intended, place the figures in holes one above another, with a strip of tin in the saw-cut between them. *Example:* To represent the number 3728, seek in fig. 4 the number 3, and place a peg in one of the holes in the position there represented; in the next hole, to the right, place a peg as represented by the No. 7 (fig. 4), &c., till the number be completed. The x, y, z may be used for any other letters, as a, b, &c., at pleasure. $2a + 3b$ with a tin over, having the notch to the *left-hand* would signify $\sqrt{2a + 3b}$, and to the right, $\overline{2a + 3b}^{3}$, &c. Between pounds, shillings, pence, &c., a hole is to be left unoccupied, and in "*Proportion*," two holes may be left in the middle. In Algebra, when the question does not involve more than *three* unknown quantities (a greater number would require an additional and differently marked peg), the quantities will be set down according to the positions found in fig. 4. The pegs may be made of any material, but cast in type-metal they are the cheapest. It will be observed that when the side of a peg is parallel to the side of the board, an *even* number is represented, and when otherwise, an *odd* number.

In carrying out the above contrivance, Mr. Taylor is indebted for many valuable hints to Mr. Abraham Pope, of No. 80, Edgeware-road, where the apparatus complete may be had.

Home Correspondence.

EXHIBITION OF 1861.

In the "summary of information bearing upon the Exhibition of 1861," which appeared in the last number of the *Journal*, I observed, with some surprise, that the Great Exhibition held at New York in the 1853 was left out of your correspondent's calculations, in consequence, as he stated, of its having been entirely a private enterprise.

If this is a correct description of the New York Exhibition, it would be equally correct to designate as private enterprises the greater number of the other Exhibitions which your correspondent ennumerates, and from which he derives his arguments. But, without attempting to enter upon any vindication of the public character of the New York Exhibition, I desire to draw attention to the fact that, so great was the interest felt in that Exhibition by our own fellow subjects resident in Canada, that one hundred thousand Canadians visited it, and recorded their names as visitors in a book kept for that purpose by the Commissioners, and now in the possession of the Canadian Government.

The New York Exhibitions exercised the most important influence for good upon the manufacturers of Ireland. This influence was no less opportune than advantageous, for the period was a critical one for Ireland, when even the ablest and most enterprising of her sons appeared to have lost all confidence both in themselves and in the future of their country.

The manufacturers of Ireland, who were large contributors to the New York Exhibition, at that time actually attached continental "trade marks" to their productions, under the impression that if they were known to be "Irish," there was no hope of their being estimated according to their worth.

It is a significant illustration of the public, and, indeed, of the national effect of that strictly "private enterprise," that in one single branch of Irish manufactures, namely, embroideries, there was an increase of upwards of one million of dollars on the exports to America, between June, 1852, and June, 1853, as compared with the previous averages; and to this statement it may very consistently be added, that the same statistical tables exhibit, during the same year, a general increase of more than 40 per cent. in the American importations of Irish linens; and this increase was still greater in the following year.

These appear to me to be arguments in support of International Great Industrial Exhibitions, worthy to be associated with your correspondent's "summary," since they bear in the most direct manner, and with no trifling authority, upon the question under consideration.

I am, &c.,
SAMUEL MARSHALL.

Westow Hill cottages, Upper Norwood,
Surrey, April 6th, 1859.

MR. VARLEY'S PAPER ON THE ELECTRIC TELEGRAPH.

Sir,—I find, in looking over the *Journal* of last week, containing the report of my paper on the practical bearing of the theory of electricity in submarine telegraphy, that some mistakes have occurred, which I appear to have overlooked when correcting the proof.

At page 310, column 1, line 51, after the word "material" there should be inserted, "or by using a wire of larger diameter."

In line 61, the weight of the conducting machine should be "93lbs. to the mile," not "63 lbs."

In the bottom paragraph of the same column, the words should be "a conductor of double the diameter will *possess* half the retarding power," and not "produce," as in the *Journal*. The price given in the same paragraph lower down, should be "not more than £19 per mile," instead of "£16." I am, &c.,
S. ALFRED VARLEY.

April 6, 1859.

PRODUCTS OF THE COMBUSTION OF COAL GAS.

Sir,—In the *Journal* for the 18th of March, there is a reply by Dr. Letheby to my observations on his letter on the subject of the formation of oil of vitriol by the combustion of coal gas. I should not otherwise have made any further observations on the subject, as I believe no one really is of opinion that coal gas has the awful effects attributed to it by Dr. Letheby, or that it is matter of common observation that all kinds of textile fabrics are rapidly destroyed by it. Speaking for myself and friends who have burnt gas for many years, we find our curtains, books, furniture, pictures, &c., last as long as those who do not burn gas at all in their apartments.

I can assure Dr. Letheby it is the wish of all gas companies to discover a means of abstracting the very small portion of sulphur which is left in the gas after it has undergone the processes at present known for that purpose; and I can promise Dr. Letheby, if he, as a chemist, can devise some plan to effect this, he will do far more good than by an attempt to decry one of the most useful inventions of modern times.

I do not intend to put my knowledge against Dr. Letheby's; he may have a method of making oil of vitriol known only to himself. I can only say, I have tried every possible way for the last five years, and up to the present time have not succeeded in obtaining one drop of oil of vitriol from the combustion of coal gas as burnt in the ordinary way.

Dr. Letheby informs you he is in the daily habit of analysing coal gas. By this, I presume, he means both pure and foul gas, or, as he terms it, raw gas; and he quotes Mr. Wright as an authority in support of his view, viz., that raw gas does not contain as it comes from the condensor more than $\frac{1}{2000}$ part of its bulk of ammonia. Now, without being a chemist, I beg distinctly to contradict Dr. Letheby as to the quantity stated. Ordinary foul gas in that stage of the process contains sufficient ammonia to saturate more than one pound of oil of vitriol per 1,000 feet of gas, or considerably over one per cent. of the weight of gas; this amount is daily used at this and other gas works, and the whole of the ammonia is even then not abstracted, sufficient being left in to neutralise any sulphur compounds still existing in the gas.

Mr. Wright informs me he did not use the expression raw gas, as quoted by Dr. Letheby, nor did his experiments have reference to anything else but purified gas, as may be easily ascertained by reading the whole of the article he wrote on the subject.

The statement of Dr. Letheby, that the whole of the ammonia is destroyed during the combustion of the gas, is not supported by my experiments; in fact, as has long since been pointed out by Mr. Lewis Thompson, when gas absolutely free from ammonia is operated upon for the purpose of ascertaining roughly the amount of sulphur compounds it contains, we purposely add ammonia to it, in order that sulphate of ammonia may be formed, and thus the amount of sulphur ascertained.

I am, &c.,
F. J. EVANS.
Gas Works, Horseferry road, March 26th, 1859.

Proceedings of Institutions.

Salford Royal Museum and Library.—The tenth Annual Report states that the Institution has been fully as attractive as in any former year. In the spring of last year, the basement story of the new wing was completed, and the mineral and geological specimens are now placed in it. The room on the ground floor has been also finished, and other improvements have been made. The Museum is much indebted to Sir James Watts, late Mayor of Manchester, for his very handsome present of four paintings, by ancient masters. On the completion of the rooms of the new wing, the Committee determined to have an Exhibition, for the summer months, of the paintings, engravings, chromo-lithographs, statuary, and other works of art belonging to the institution, which they accordingly arranged, and to which many additions were made from private collections. The following table shews the number of visitors to the Museum for the last twelve months.

Months.			Quarters.		
	Days Opened.	Visitors.	Days Opened.	Visitors.	Daily Average.
1857—November......	21	16,100	66	79,600	1,200
December	23	23,200			
1858—January.........	22	40,300			
February	20	40,800	64	126,561	1,961
March	23	38,700			
April	21	47,064			
May...............	23	93,180	63	190,120	2,795
June	23	53,040			
July	22	44,900			
August	22	51,800	67	142,160	2,121
September......	22	46,860			
October.........	23	43,500			
	265	538,444	Daily average ...		2,032

The total number of volumes issued from both departments of the Library, during the last twelve months, have been—From the Reference, 86,418 volumes, Lending, 75,256—total, 161,674. There is a slight increase in the former department of 2,076 volumes over last year, and 6,484 when compared with 1856; but the operations of the Lending Library have been so much extended, as to make the number of volumes issued to be nearly 20 per cent. more than the highest return of former years,—the actual numbers are 11,784 over 1857, and 12,706 over the previous year. There have been added 1,208 volumes by donations, and 660 by purchase, so that the Library now contains 22,371 volumes, classified as follows:—Theology and Ecclesiastical History, 1,071; Jurisprudence, Political Economy, Parliamentary Papers, and Blue Books, 3168; History, Travels, and Biography, 6,370; Science and the Arts, 3,916; Poetry and Drama, Magazines, Essays, Periodicals, Reviews, and Translations of the Classics, 3,799; Novels, and all Works of Fiction, 4,047; Total, 22,371. The following are the numbers issued under each head during the last three years:—Theology and Ecclesiastical History, 1856, 2,338; 1857, 3,421; 1858, 4,449; Jurisprudence, Political Economy, Parliamentary Papers, and Blue Books, 1856, 900; 1857, 1,631; 1858, 1,699; History, Travels, and Biography, 1856, 14,395; 1857, 16,217; 1858, 13,774; Science and the Arts, 1856, 15,035; 1857, 17,212; 1858, 13,730; Poetry and Drama, Magazines, Essays, Periodicals, Reviews, and Translations of the Classics, 1856, 23,512; 1857, 23,459; 1858, 28,800; Novels, and all Works of Fiction, 1856, 23,754; 1857, 22,582; 1858, 23,996; Total, 1856, 79,934; 1857, 84,342; 1858, 86,418. The Specifications of Patents, to which 5,257 references have been made during the year, principally by mechanics, now number 28,047 separate Specifications, and when bound will make 1,100 volumes, In the Lending Library the following have been the issues:—Theology, and Religious Tract Society's Publications, 1856, 2,923; 1857, 3,734; 1858, 3,450; History, Travels, and Biography, 1856, 10,666; 1857, 12,304; 1858, 13,197; Science and the Arts, 1856, 6,737; 1857, 7,284; 1858, 3694; Poetry and Drama, Magazines, Essays, Reviews, Periodicals, and Translations of the Classics, 1856, none; 1857, none; 1858, 4,242; Novels, Tales, and all Works of Fiction, 1856, 42,324; 1857, 40,150; 1858, 50,693; Total, 1856, 62,550; 1857, 63,472; 1858, 75,256. From statistics compiled by the librarian as to the occupations of those making use of the library, three-fourths of them are strictly belonging to the working classes, the numbers being, from March 1st, to October 31st, 1858,—Females (mostly young) 466; youths under sixteen years of age, 399; journeymen, workmen, shopmen, mechanics, &c., 667; clerks, warehousemen, schoolmasters, and teachers, 308; soldiers, 125; policemen, and persons of no trade or calling, 51; total, 2,014. The borrowers take great care of the books, and for the most part return them regularly. No case of wilful damage has occurred, and very few accidental ones. The Library has increased from 7,000 volumes, in 1850, to 22,371, in 1858. The Committee state that they are quite satisfied with the working of the Reference and Lending Departments of the Library, and call attention to the foregoing statistics, as shewing the increasing popularity and usefulness of the Institution; and inasmuch as the Lending Library is now amply supplied with books well adapted for it, they recommend their successors to expend a greater proportion of the funds at their disposal, than heretofore, in the purchase of standard works of a high class, for the Reference Library.

Windsor and Eton Literary, Scientific, and Mechanics' Institution.—A lecture was delivered at this Institution on Tuesday evening, the 8th of February, by William Johnson, Esq., of Eton College, on Sir Walter Scott. After noticing that an exception was made in favour of the novels of Sir Walter Scott by many persons who objected to novel reading in general, the lecturer proceeded to inquire to what merit Scott owed this distinction, and he thought it consisted in his generosity and manliness of mind. Before Scott, the historical novel could not be said to exist, and he was not so likely to mislead as many novelists who had succeeded him. The lecturer proceeded favourably to contrast Scott as a novelist of this class with Bulwer and Alexander Dumas. The mistakes made by Scott were merely those of carelessness. He was not, however, so successful in delineating the manners and domestic scenes of common life as Miss Ferrier, Miss Austen, and other ladies who had adopted that description of novel. His *St. Ronan's Well* was referred to as an instance of this. There was no excessive nationality displayed in his works, although he was a most patriotic writer, and made Scotland classic ground. Scott was in general liberal in describing parties from whose political and religious views he differed. One man might be compared with Scott in extent of knowledge, Lord Macaulay, and the comparison could be easily made by referring to the notes to Scott's edition of Dryden's *Political Satires*, which had reference to a period of which Lord Macaulay treated. The lecturer reviewed the life of Scott, marking the periods at which his poetical works were produced, referring to his flattering receptions in London and Paris when in the zenith of his fame, and describing his subsequent misfortunes, and the strenuous exertions made by him after his bankruptcy to clear off his debts, no less than fourteen hours a-day being spent by him continuously in literary labour. At the close of the lecture the thanks of the audience were tendered to Mr. Johnson, by Captain Wilson, one of the Vice-Presidents of the Society.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Mr. John Ella, "On Chamber, Orchestral, and Ballet Music."
Medical, 8.
Geographical, 8½ 1. Commander Bedford Pim, R.N., "Brief Remarks upon the Isthmus of Suez, with special reference to the Proposed Canal, &c." 2. Sir J. Herschel, Bart., "On a New Projection of the Sphere,' communicated by Sir R. I. Murchison. 3. Communication by Major T. Stokes, R.E., "Notes on the Lower Danube."
Tues. ......Royal Inst. 3. Professor Owen, "On Fossil Mammals."
Syro-Egyptian, 7½. 1. Mr. Sopwith, "Information regarding the Sixty-four Apis found in the Vault of the Serapium." 2. Mr. Bonomi, "Explanation of the Mode in which the Granite Sarcophagi which contained the Mummy of the Apis was lowered into its place in the Vault of the Serapium, and of the means proposed by Mr. G. Stephenson for raising it."
Civil Engineers, 8. 1. Discussion "On the Permanent Way of the Madras Railway." 2. Mr. W. J. Kingsbury, "Description of the Entrance, Entrance Lock, Wrought-iron Gates and Caisson of the Victoria (London) Docks.
Medical and Chirurg., 8½.
Zoological, 9.
Wed. ......Literary Fund, 3.
Society of Arts, 8. Mr. H. Hyde, "On Professor Hughes's System of Type-printing Telegraphs and Methods of Insulation, with special reference to Submarine Cables."
Graphic, 8.
Archæological Assoc., 8½.
Thurs .....Royal Inst., 3. Prof. Tyndall, "On Pneumatics."
Royal Soc. Club, 6.
London Inst., 7. Professor Bentley, "On Vegetable Substances used for the Food of Man."
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri..........United Service Inst., 3. Dr. W. Farr, "On the Application of Statistics to Naval and Military Matters."
Royal Inst., Meeting, 8; Lecture, 9. Sir Charles Lyell, "On the Consolidation of Lava on Steep Slopes, and on the Origin of the Conical Form of Volcanoes.
Sat. ......Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 3rd March, 1859.

99. Manning the Navy—Copy of Letter of W. S. Lindsay, Esq.
6. Railway and Canal Bills: 80, Border Union (North British) Railways; 109, Birkenhead, Lancashire, and Cheshire Junction Railway; 110. London and North-Western Railway (arrangements)—Board of Trade Reports.
50. Bill—Endowed Schools (No. 2).

Delivered on 4th March, 1859.

83. Landed Estates Court (Ireland)—Copy of Rules and Orders.
89. Committee of Selection—2nd Report (a corrected copy).
95. Lunatic Asylums (Ireland)—Return.
98. Magistrates (County Palatine of Lancaster)—Return.
103. Clothing (Army)—Return.

Delivered on 5th and 7th March, 1859.

31. Seamen and Marines Invalided—Return.
105. Corn and Grain, &c.—Accounts.
108. Navy—Supplementary Estimate.
6. Railway and Canal Bills (111, Border Counties Railway: 112, Carlisle, Langholm, and Hawick Railway; 113, Great North of Scotland Railway; 114, Leatherhead and Dorking Railways (No. 2); 115, London and North Western and other Companies (Working and Traffic Arrangements); 116, London and South Western Railway Act Amendment; 117, Liverpool, Garston, and Allerton Railway; 118, Manchester, Sheffield, and Lincolnshire Railway (Sale or Lease); 119, Metropolitan Railway (Abandonment of Undertaking); Metropolitan Railway (Deviations, &c); 120, Newcastle under Lyme, Silverdale, and Madeley Junction Railway; 121, Nuneaton and Hinckley Railway; 122, Portsmouth New Docks and Railway; Portsmouth Railway; 123, Sittingbourne and Sheerness Railway (Working Arrangements, &c.); 124, Somerset Central Railway; 125, Ulster Railway; 126, Victoria Station and North Western and Great Western Junction Railway 127, West End of London and Crystal Palace Railway (No. 1): West End of London and Crystal Palace Railway (No. 2); 128. Wimbledon and Dorking, and Epsom and Leatherhead Railways; 129, Great Western Railway)—Board of Trade Reports.
50. Local Acts (29, Victoria Station and North Western and Great Western Junction Railway; 30, West London Railway; 31, South Metropolitan Railway and Westminster Station; 32, West London and Pimlico Railway; 33, North London, Paddington, Richmond, &c., Railway; 34, Victoria Station and Pimlico Railway; 35, Swanage Railway and Pier; 36, Llyfni Vale Railway and Harbour)—Admiralty Reports.
80. Harbour, &c., Bills (2, Fishguard Harbour Improvement; 3, Forth and Clyde Navigation; 4, Greenwich and South Eastern Docks; 5, Isle of Wight Ferry; 6, Kingston upon Hull Docks; 7, Kirkwall Harbour; 8, Victoria (London) Docks; 9, Whitehaven Port, Harbour, and Town, &c.; 10, King's Linn Borough and Port Harbour Improvement; 11, Tyne Improvement; 12, Weymouth and Melcombe Regis Markets and Pier)—Board of Trade Reports.
52. Bills—Petitions of Rights.
53. ,, Affidavits by Commission.
54. ,, Titles to Landed Estates (amended).
55. ,, Registry of Landed Estates (amended).
56. ,, Municipal Elections (amended).
57. ,, East India Loan.
58. ,, County Courts.
59. ,, Newspapers, &c. (amended).
62. ,, Remission of Penalties.

Session 1857-8.

98 (A xii). Poor Rates and Pauperism—Return (A).

Delivered on 8th March, 1859.

17. Police (Counties and Boroughs)—Reports of the Inspectors.
40. Local Acts (37 Sweed Fisheries)—Admiralty Report.
94, Superannuations—Copies of Order in Council and Treasury Minutes.
101. Customs, Excise, &c.—Returns.
111. Slave Trade (Zanzilar)—Returns.

Delivered on 9th March, 1859.

6. Railway and Canal Bills (130, Chester and Holyhead Railway); 131, Isle of Wight Railway (Eastern Section); 132, Lancaster and Carlisle Railway; 133, Liverpool Stations Junction Railway (No. 2); 134, North and South London Junction Railway; 135, North Staffordshire Railway; 135, Oldham, Ashton-under-Lyne, and Guide Bridge Railway (Working of Line, &c.); 137, Sirhowy Tramroad; 138, South Staffordshire Railway (Supplemental Report); 138, Vale of Neath Railway—Board of Trade Reports.
80. Harbour, &c., Bills (Commercial Docks Act Amendment)—Board of Trade Report.
109. African Mails—Copy of Correspondence.
11. Charity Trustees—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 1, 1859.]

Dated 16th December, 1858.

2880. R. Wilson, sen., and R. Wilson, jun., Livesy street, Manchester—Certain imp. in the preparation of leather in combination with india rubber and other materials, for the manufacturing of hose pipes and other purposes where leather is required to be impervious to water, steam, or frost.

Dated 19th February, 1859.

460. T. Earle, Clapham, Surrey—Improved apparatus for conveying signals to railway trains in motion.
462. W. Basford, Burslem, Staffordshire—Imp. in the method of, and means for, drying bricks and tiles preparatory to their being burnt, and also in the construction of kilns or ovens for burning such bricks, tiles, pipes, pottery, or earthenware, and in the mode of charging or placing these said articles therein to be burnt or fired, and also in certain appliances for regulating the heat therein.

Dated 25th February, 1859.

516. G. Peover, Wilmington-square, Clerkenwell—An improved optical instrument, being an improvement upon the kaleidoscope.

Dated 8th March, 1859.

600. J. King and A. Wilcock, Moss Mill, near Rochdale, Lancashire—Imp. in certain parts of machines used in preparing, spinning, and doubling cotton and other fibrous materials.
602. W. Halliday, Wakefield—Imp. in apparatus for preventing smoke and economizing fuel.
604. C. Mills, High-street, Camden-town—Imp. in the action of pianofortes.
606. E. Deane, 1, Arthur-street East, London Bridge—Imp. in apparatus for the transmission of gas and other fluids.
608. B. M. Belling, 55, Queen's-road, Bayswater—An improved apparatus for hardening india rubber for the bases of teeth.

Dated 9th March, 1859.

610. J. A. Williams, Baydon, Wiltshire—Imp. in machinery or apparatus for cultivating land by steam power.

612. J. R. Nicholson, Redditch, Worcestershire—New or improved machinery to be used in the manufacture of needles, a part or parts of which said machinery may also be used for pointing pins and other like articles.
614. G. C. Pearce, Cyfarthfa, Glamorganshire—An imp. in cornets, trumpets, trombones, and other like wind instruments.
618. W. E. Newton, 66, Chancery-lane—Imp. in billiard tables. (A com.)

Dated 10th March, 1859.

620. J. C. Martin, High-street, Barnes, Surrey—An imp. in the manufacture of cannon and small fire-arms, and of projectiles to be used with the same.
622. R. F. Woodward, Birmingham—An imp. or imps. in the manufacture of certain kinds of scale beams and fittings used therewith.

Dated 11th March, 1859.

624. J. H. Burton, Enfield Lock, Middlesex—An imp. in breech-loading fire arms.
630. A. V. Newton, 66, Chancery-lane—An improved construction of steam engine, applicable also to the raising of water. (A com.)

Dated 12th March, 1859.

632. W. E. Newton, 66, Chancery-lane—An imp. in endless chain propellers for boats and other vessels. (A com.)
638. R. Allison, Birmingham—Imp. in apparatuses for boring and sinking.

Dated 14th March, 1859.

640. R. Waller, 50, Baker-street, Portman-square—Imp. in joining leather, flexible and textile materials, for the production of boots and shoes, and articles of the like description, and harness, strapping, bags, sails, tent covers, portmanteaus, and such other articles, together with machinery and apparatus for that purpose.
642. A. Tylor, Warwick-lane, Newgate-street—Imp. in apparatus for regulating the supply of water to water closets and other vessels.
644. D. Joy, Leeds—Imp. in hydraulic engines and meters.
646. E. Smith, Dudley Port, Staffordshire—Imp. in treating or preparing furnaces used in the manufacture of iron.
648. J. S. Dawes, Smethwick-house, near Birmingham—A new or improved method, or combination of arrangements for the better securing and collecting of night-soil or town manure, and rendering it more valuable for agricultural purposes.

Dated 15th March, 1859.

650. C. Desurmont, Seclin, France, and C. Goudeau, Alost, Belgium—Certain imp. in looms for weaving.
652. C. Ritchie, 143, Strand—Imp. in calculating machines.
654. B. Rider, 61, Red-cross-street, Borough—Imp. in hats, caps, and other coverings for the head, and in the apparatus used in the manufacture of such articles.

Dated 16th March, 1859.

655. J. Dixon and R. Clayton, Bradford—Imp. in rolling iron and steel for manufacturing railway wheels and for other purposes.
657. W. Robertson and J. G. Orchar, Dundee—Imp. in weaving.
659. J. Parker, Claremont cottage, Lilford road, Camberwell, Surrey—Imp. in lever sails, and in submerged feathering propellers.
661. F. Mordan, Goswell-road, Middlesex—A means of keeping a stopper connected with a bottle, jar, or such like receptacle, when removed from the mouth thereof.
663. J. Fuller, Reading, Berkshire—Imp. in churns.
665. J. Michel-Denys, 4, South-street, Finsbury—Certain imp. in the construction of railway crossings.
669. G. Hamilton, St. Martin's-le-Grand, and W. H. Nash, Poplar—Imp. in tumbler or lever locks, and in keys for such and other locks.
671. T. W. Miller, H.M. Dockyard, Portsmouth—Imp. in blocking or securing ships and other vessels whilst being removed, examined, or repaired.

Dated 17th March, 1859.

673. C. Garnett, Cleckheaton, Yorkshire—Imp. in machinery for ginning cotton, and for cleaning cotton and certain other fibrous materials.
675. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for crushing sugar-canes and other materials. (A com.)
677. T. Skelton, Plaistow, Essex—Imp. in steering apparatus.
679. P. Larochette, Paris—Imp. in machinery for brewing.
681. A. Warner, 31, Threadneedle-street, and W. H. Tooth, Sumner-street, Southwark—Imp. in the manufacture of iron.

Dated 18th March, 1859.

683. W. Cook, Kingston-upon-Hull—A smoke consumer.
685. Sir W. G. Armstrong, Knt., Newcastle-upon-Tyne—Imp. in the means of igniting explosive projectiles.
687. J. Molesworth, Rochdale—An imp. in telegraphic communication. (A com.)
689. J. Hinks and G. Wells, Birmingham—A new or improved penholder.
691. R. Mushet, Coleford, Gloucestershire—An imp. in the manufacture of cast steel.
693. C. Lambert, Sunk Island, Yorkshire—Imp. in corn and seed drills.

Dated 19th March, 1859.

695. T. Allen, Waingate, Sheffield—Imp. in petticoats.
697. E. L. Benzon, Sheffield—An imp. in the casting of steel. (A com.)
699. H. Whitaker, Newman street—A new musical instrument, to be called "The Cherubine Minor."
701. W. Haigh, Reddish, Lancashire—An improved manufacture of paper, to be employed for the purposes of packing and other similar uses.
703. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of cast steel.
705. A. V. Newton, 66, Chancery-lane—Imp. in propelling vessels. (A com.)

Dated 21st March, 1859.

707. W. Haggett, Sherborne, Dorsetshire—An improved method of treating metals and other materials to increase their strength.
709. W. Hudson and C. Catlow, Burnley, Lancashire—Certain imp. in looms for weaving.
711. G. Ferguson, Strand—The combination and application of certain materials for the destruction of insects and vermin.
713. S. Leoni, Saint Paul-street, Middlesex—Imp. in the manufacture of useful and ornamental articles, surfaces, and works, parts of articles and parts of machinery or apparatus, from talc and other silicates of magnesia, and from the same combined with other substances.
715. G. Gregg, Sheffield—Imp. in currying or manufacturing leather.
771. W. Rhodes, Wade-street, Thornton-road, Bradford—Certain imp. in fire proof safes.

Dated 22nd March, 1859.

719. J. Davis, 18, Frith-street, Soho—Imp. in musical instruments.
721. W. A. Gilbee, 4, South street, Finsbury—An improved apparatus for stretching and polishing silk thread. (A com.)
723. F. Ashford, Commercial-road East, London—Improved means of fastening and securing treasure or bullion cases.
725. E. Maynard, Washington, U.S.—Improving breech-loading fire arms.
729. Sir P. Fairbairn and R. Newton, Leeds—Straightening and separating the fibres of silk waste, and laying them in parallel lengths preparatory to combing or dressing.
731. R. A. Brooman, 166, Fleet-street—Imp. in fire-arms and ordnance, and in projectiles and apparatus to be employed therewith. (A com.)
733. C. A. Watkins, Greek-street, Soho-square—Imp. in the manufacture of brushes.

Invention with Complete Specification Filed.

780. W. Mossman, 50, Cumming-street, Pentonville, Clerkenwell—Imp. in machinery applied to embossing or cutting presses, for the better and more expeditious manner of manufacturing ornamental cut out and embossed work in paper, leather, parchment, cloth, foil, and other materials.—29th March, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, April* 1, 1859.]

April 1st.
2194. W. Brierley.
2198. J. C. Holman and E. W. Holman.
2206. J. Mills.
2207. A. Bessemer.
2209. W. Menelaus.
2211. J. H. Brown.
2213. J. H. Brown.
2219. G. Collier.
2223. W. Malam.
2225. C. Baylis.
2230. D. Naylor.
2248. A. E. Galliard.
2251. L. Hope.
2292. W. Clark.
2296. T. Archer.
2303. T. Moore.
2307. G. F. Wilson.
2364. R. Kennedy and J. Armstrong.
2372. W. E. Newton.
2376. J. J. Welch and J. S. Margetson.
2383. S. R. Parkhurst.
2406. A. Heywood.
2409. W. Munro.
2436. W. Palmer.
2439. M. A. F. Mennons.
2879. W. Morgan.
2987. T. Bell.
68. E. Cobbold.
147. W. Newman.
249. H. Rawson.
250. J. Buckingham and G. Salt.
302. J. Buncher.
326. Patrick Adie.
352. Dr. E. Bagnicki.

[*From Gazette, April* 5, 1859.]

April 5th.
2137. A. F. Jaloureau.
2212. G. Hamilton and W. H. Nash.
2217. J. Luis.
2226. D. Nicoll.
2229. J. C. Nouveau.
2234. J. Luis.
2243. C. W. Lancaster.
2252. W. Crofts.
2301. W. Bacon.
2337. R. A. Brooman.
2398. T. Almond.
333. R. Tinkler.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, April* 1, 1859.]

March 28th.
786. J. Gray.
923. W. Tytherleigh.
March 29th.
770. B. Looker.
902. W. Fuller.
908. A. V. Newton.
March 30th.
1024. J. Rigby.

[*From Gazette, April* 5, 1859.]

April 1st.
801. J. Samuel & J. Nicholson.
818. C. W. Ramié.
833. F. G. Underhay.
April 2nd.
820. J. G. Martien.
827. J. Bernard.
838. J. Leigh.
915. Capt. H. Y. D. Scott, R.E.
989. F. W. Blacket.

Journal of the Society of Arts.

FRIDAY, APRIL 15, 1859.

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

EXAMINATIONS, 1859. — LOCAL BOARDS.

The following Local Boards have been appointed since the last announcement:—

For Frome.

Rev. D. Anthony, B.A., Independent Minister.
Mr. Bailey, Master of British Schools.
Mr. Bioletti, Master of National School.
Mr. Ellis, Master of Endowed Blue Coat School.
Mr. Alfred Haynes, Mechanics' Institution, Frome, *Secretary.*

For Hitchin.

Rev. L. Hensley, President.
Mr. W. Hawkins, Vice-President.
Mr. D. Lloyd.
Mr. F. Lucas.
Mr. W. Lucas.
Rev. G. M. Musgrave.
Mr. J. Hack Tuke.
Mr. Joseph Pollard, Highdown, near Hitchin, *Secretary.*

For Leeds' Mechanics' Institution and District.

Mons. Brocard.
Rev. C. H. Collier, M.A.
Rev. Thomas Hincks, M.A.
Mr. James Hole.
Mr. Oliver.
Herr Reunert.
Mr. Scattergood, M.R.C.S.
Mr. H. E. Kincaid, }
Mr. John Pickering. } *Secretaries.*

For Wakefield.

Rev. Goodwyn Barmby.
Rev. J. S. Eastmead.
Mr. W. Williamson, Registry, Wakefield, *Secretary.*

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

EXHIBITION OF INVENTIONS.

The Society's Eleventh Annual Exhibition of recent Inventions will be opened on Monday the 25th inst.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman. Cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

Members of Institutions who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following letter has been addressed, by direction of the Council to the Secretary to the Trustees of the National Gallery.

Sir,—I am directed by the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce, to make the following appeal to the Trustees of the National Gallery:—

The Chancellor of the Exchequer has stated in Parliament, that the Turner and Vernon collections of paintings and drawings, in charge of the Trustees of the National Gallery, are to be exhibited to the public in the new galleries which have been built, and are now almost completed, in connexion with the Museum at South Kensington. In those new galleries, however, no provision has been made for artificial light, and, therefore, an apprehension is felt that it is the intention of the Trustees that the collections in question shall not be open to the public except during the hours of daylight.

The Council begs leave to represent to the Trustees that the whole of the collections already in the Museum at South Kensington, including the Sheepshank's gallery of paintings and drawings, have been hitherto systematically opened to the public of an evening, as well as by day, under the authority of the Committee of Council on Education, and have been visited of an evening by very large numbers of persons, whose conduct has been irreproachable.

The Council considers it highly important to the interests of arts and manufactures, that the national collections of the fine arts shall be open as freely as possible to the view of the public in general. There can be no difficulty in guarding against risks of fire, or other injuries incidental to the use of artificial light. There must always be large numbers of persons, residents or visitors in London, who, being occupied throughout the day in business, can only visit a gallery of art in the evening; and, if all these persons are excluded at the only time which is available for them, and this exclusion is established by the Trustees of the National Gallery, in exception to the beneficial rule which has hitherto prevailed, with excellent results, at South Kensington, a large amount of grave dissatisfaction, it is feared, must necessarily be the consequence.

The Council of this Society confidently hopes that the Trustees of the National Gallery may assent to the proposition, that the establishment and maintenance of museums and galleries at the public expense is commendable, and, indeed, justifiable, only where the fullest possible opportunities of seeing and profiting by the collections are afforded to the public; and experience has proved that, whenever any exhibition interesting to the great masses of the people is open to them, without any unnecessary limitations, it is visited by them in large numbers; and their behaviour, in all the essentials of good conduct, may safely challenge a comparison with that of the very highest classes.

The Council has much pleasure in laying before the trustees a copy of a resolution, which was passed unanimously by the representatives of the three hundred Institutions united to this Society, at the last annual conference, on the 24th of June last, viz.:—

> "That this Conference requests the Council of the Society of Arts to bring under the consideration of Her Majesty's Government the question whether the National Museums and Galleries cannot and ought not to be opened of an evening, in order that they may be accessible to those numerous classes of the community who, contributing towards the expenses of maintaining the National Museums and Galleries, and being well able to profit by access to them, are at present practically debarred from visiting them, because they are open only during the day."

The Council has no doubt that the trustees are not only willing but anxious that the national collections intrusted to their charge should be seen and used by the public as freely as possible, and the Council earnestly requests the trustees to consider whether they cannot take advantage of the temporary exhibition of the Turner and Vernon Collections at South Kensington, to allow them to be open to the public of an evening as well as by day.—I am, &c.,

P. LE NEVE FOSTER, Secretary.

NINETEENTH ORDINARY MEETING.

Wednesday, April 13, 1859.

The Nineteenth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 13th inst., Wm. Fothergill Cooke, Esq., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Norton, John
Weeks William Henry
Varley, Cromwell Fleetwood

The following Institution has been taken into Union since the last announcement:—

The British Horological Institute.

The Paper read was—

ON PROFESSOR HUGHES'S SYSTEM OF TYPE-PRINTING TELEGRAPHS AND METHODS OF INSULATION, WITH SPECIAL REFERENCE TO SUBMARINE CABLES.

By Mr. H. Hyde.

The several phenomena which have been manifested in the working of long submarine telegraph cables, demonstrate the necessity of improving the insulation of the wires, and of economising the transmission and recording of symbols. Imperfect insulation not only implies a diminution of the electric current, but may, and frequently does, increase to a total loss, and the cable becomes useless.

The insulation being good when the cable leaves the manufacturer, it is subject to so many accidents before it reaches the bottom of the ocean, that the chances are greatly in favour of a long line receiving some damage, which cannot be repaired after it is laid down. More perfect insulation, and a self-restoring power which should make the cable itself, even at the bottom of the ocean, repair any accidental defect, are most important desiderata in the science of ocean telegraphing.

The great expense of a length of cable, of any construction, sufficient to join England and America, must necessarily be such as to render economy of time in the transmission of messages a matter of primary importance.

Through a single wire, the waves of the electric force can only follow one another in single file. Whatever may be the time occupied in the transmission of a single wave, it is of no small importance, whether it takes from five or six, or only a single wave, to communicate the signal of any letter of the alphabet. The short experience of the working of the Atlantic cable has demonstrated the importance of these positions. I need therefore offer no apology to the members of the Society of Arts, for bringing before them the methods by which Professor Hughes seeks to improve the insulation of submarine and other wires, to render them self-repairing, and to economise and render at the same time the means of despatch accurate and self-recording.

First—Insulation.

Gutta percha has been found to be the best insulation for long submarine lines. This substance, however, is more or less porous; minute flaws may exist, which do not show themselves until some time after the immersion of a cable. This was exemplified by Mr. Henly, who discovered a flaw in his submarine cable, which did not show itself until it had been three or four days under water. To meet these defects, to fill up any minute pores in the gutta percha, and also to cure any accidental fracture or puncture of it, Professor Hughes introduces a viscid semi-fluid substance, of a non-conducting character, between the conducting wire and the gutta percha, or the wire may first be coated with gutta percha, and the viscid fluid introduced between the layers of gutta percha. As soon as a puncture is made in either of the gutta percha coatings, the semi-viscid fluid oozes out. It is of such a nature, that it hardens when it comes in contact with the surrounding water.

This hardening or coagulating property allows no more of the fluid to ooze out than is necessary to fill the fracture, and at the same time to glue and unite the separated parts of the gutta percha.

The first feature in this form of cable is its self-restoring power; but it has another, and perhaps more important one. It has been shown, I think by Professor Faraday, that a fluid which cannot be decomposed by electricity is the most perfect insulator. Should this be demonstrated in practice, the invention of this form of cable must be valuable as a means for greatly increasing the non-conducting power of the medium surrounding the conducting wire. It is well known that cables become defective in insulation after being submerged for some time. It has been supposed that the forces of the electric current burst the gutta percha covering under certain circumstances. It has also been urged that, in consequence of this tendency, battery power should be used instead of induced currents.

Professor Hughes has demonstrated that voltaic currents exert no mechanical force whatever upon the insulating coating of a conducting wire.

If there be a defect in the coating it may be enlarged by strong currents, either voltaic or induced. But, if there be no pore or crack through which the current can first commence its work of destruction, no voltaic current would exert sufficient force to tear a piece of paper. This has been shown by putting a piece of cable, three feet long, made upon Professor Hughes's plan, into a bath of salt water. Its complete insulation was tested by a delicate galvanometer and a battery of 500 cells. A fracture, an inch long, was then made through the gutta percha and the viscid substance, allowing the salt water to reach the wire; the galvanometer immediately was deflected from zero to 90°, showing dead earth.

In the course of five or ten minutes the viscid substance worked its way around the uncovered wire, and oozed out to the water through the fracture. It then coagulated, and thus repaired the injury, and completely restored the insulation. The whole force of the current from the 500 cells was kept constantly passing into the wire during the whole of this operation.

In illustration of the varied effects of different descriptions of fractures upon submerged cables, it may be instructive to note that if the conducting wire be made bare by a fracture of considerable size, having breadth as well as length, the immediate effect will be dead earth, or the instantaneous deflection of the needle to 90°. If the fracture be fine, or narrow, the effect will be a deflection of the needle to a greater or less extent, say from 70 or 90°, with a constant vibration of from five to ten degrees, or even more. This deflection and the vibrations will continue as long as the current is kept upon the wire, and often resemble the vibrations produced by a manipulator. This peculiar phenomena may, in some degree, account for the peculiar vibrations which so much puzzled the electricians during the short life and last moments of the Atlantic cable. These vibrations are probably produced by the decomposition of water by the electric current. The hydrogen gas escaping from the point of contact with the wire in an elongated bubble fills the fracture while passing through it, thus alternately opening and closing the circuit.

Secondly—Instruments.

In the early history of electric telegraphing, inventors were impressed with the advantages of using the alphabet in general use for transmitting communications, instead of characters or symbols, a mode which naturally suggested itself as the best, if practicable.

While electrical knowledge was confined to but few, mechanical knowledge, as applicable to its development, was also limited in the same or a still greater ratio. Hence, the mechanical means by which electric currents were made to convey or record signals were crude and simple, and the work was, if not cheaply, at least slowly, roughly, and often inaccurately done.

Among the earliest applications of electro-magnetism to telegraphic purposes, was the vibration of a magnetic needle to the right or left, at the will of the operator, by passing an electric current through the apparatus, or around the needle.

These vibrations are arranged into a code of signals, and the receiver spells off the message from the moving needle, and translates the signals to an amanuensis, who commits them to paper. But in the event of errors by this process, there is nothing to show whether the sender's hand was correct, or the receiver's eye undeceived, or the copyist's ear unerring, or, if a difference arises between them, the evidence may be equally in favour of each. To ascertain who is in fault is difficult, the instrument being visual or non-recording. This primitive method is now generally used in Great Britain. On the Continent, however, Morse's self-recording instrument is generally used.

The main features of this instrument consist in making a temporary magnet of a piece of soft iron, by passing a current of electricity through it, attracting an armature attached to one end of a lever, thus pressing a stile upon the other other end against a strip of paper moved by clockwork at an uniform rate of speed. By this means the manipulator is enabled to record, both at the home and distant stations, symbols, consisting of short and long lines, with blank spaces. These hieroglyphics are translated by the receiving clerk, written out, and enclosed to the person for whom the message is intended.

The Morse instrument is used upon many of the American lines. A roman type-printing instrument, the invention of Mr. House, is also used to some extent in America. It is more rapid than the Morse, printing accurately twelve to fifteen hundred words an hour in ordinary working, and is therefore approved upon lines which have a great amount of business.

It is, however, more complicated than the Morse or the Hughes' instruments, and requires an immense battory power to work it, so much so that it is not practicable, upon the best air or overground lines, for circuits of more than 150 miles, while upon underground or submarine wires it has not, and I believe cannot, be worked thirty miles.

The House instrument is based upon the step-by-step motion, or that the number of waves sent shall determine the letter to be printed. The type is made to revolve by means of a treadle, but is checked at each letter by an escapement, which only allows it to move one letter at a time.

This escapement is moved by the flow of compressed air upon alternate heads of a plunger. The passage of air is governed by a valve attached to the armature of the axial electro-magnet, each wave of the voltaic current causing an action of the magnet, and consequently of the plunger and escapement, by the air force.

Compressed air is used to get greater power on the escapement, as the electric current would be too weak to move the escapement, whilst sufficient to move the armatures and valve. In the transmission of a message, the operator sending it, checks a circuit breaker at a certain number of waves, and this stops the type-wheel of the distant instrument by means of the escapement; and, as soon as stopped, a press is unlocked, which imprints the letter.

This unlocking of the press is very ingenious, its action depending on the motion of the type-wheel. The main constituents of this instrument are the transmitting apparatus, a compound axial magnet, and a manual power by which the instruments are kept in motion.

The instruments thus concisely described, as well as all minor ones hitherto worked with one wire, require an average of five or more electrical impulses or waves, or the time equal to this number, to transmit one letter.

The recording in roman type each letter of a message by a single wave, upon one wire, is the triumph of the Hughes' system. To accomplish it, several requisites are necessary, which it may be proper to state, and then proceed to show how they are each obtained, and, united in one harmonious whole, producing that life-like automaton present to demonstrate before you what is advanced, and practically speak for itself in plain English.

These requisites are, first, synchronous motion; secondly, an electro magnet, by which the timing of the electrical wave may be accurately measured; thirdly, a writing apparatus, by which the message may be correctly, rapidly, and easily transmitted; fourthly, a printing apparatus, by which the operator can record the message unerringly upon his own instrument, as well as upon the one at the distant station.

Many inventors have attempted to make an instrumment, by which a letter could be sent by one wave, but without success. One reason was, that they had no governor of sufficient velocity and accuracy, to produce rapid synchronous motion.

Professor Hughes applies a vibrating spring to govern his instrument. It is a well-known law that a certain number of vibrations produces a certain musical tone; therefore, if two or more springs have the same tone they must necessarily have a similar number of vibrations in the same time. The instruments are kept in motion by a weight acting upon a train of wheels, the spring governor acting upon them by means of an ordinary escapment.

These vibrations may succeed each other with any degree of rapidity required. They are regulated by a small weight attached to the spring, and raised or lowered until the number of vibrations or desired tone is produced. This can be done easily and quickly, although the instruments may be any number of miles apart—say between London and Paris, or Ireland and America.

The type-wheels of the instruments now exhibited, revolve at the rate of one hundred and twenty revolutions per minute, and the governor makes fifty-six vibrations for each revolution of the wheel.

The Magnet.

The Hughes' magnet is of peculiar construction. A permanent magnet polarizes the cores of an electro magnet, and holds an armature in contact with its poles. A spring is attached to this armature, and so adjusted as to exert a counteracting power a little weaker than the force of the magnetic attraction. If, therefore, the magnetic force be diminished, the armature is removed from the poles of the magnet by the force of the spring.

The arrangement is such that the current of electricity passing through the coil when the circuit is completed, induces an opposite magnetism to that of the permanent magnet. The electrical force, therefore, which works this instrument, need not be sufficient to induce such a degree of magnetism, as to render the core sufficiently magnetic to attract an armature to its poles—the practice in all other recording telegraphs. For instance, if the cores of the electro-magnet, polarised by the permanent magnet, have a holding force upon the armature of ten, and the spring attached to the armature be adjusted with an opposing force of nine, then a currrent of one reducing the force of the electro magnet, would cause the spring to rise with the force of nine.

This arrangement can in practice be so nicely adjusted as to work with a very feeble current, and accurately measure the timing of the electrical wave. The armature being mechanically restored to contact with the poles, has the advantage of being acted upon by the maximum power of the electro-magnet, instead of a power lessened by more than the square of the distance the armature has to be attracted, as is the case in the relay magnets used in connection with the Morse and other systems.

Transmitting Apparatus.

The letters of the alphabet, as well as a dot and a blank, are marked on twenty-eight keys, arranged like those of a piano, save that they are alternately black and white. These keys correspond to twenty-eight holes arranged in a circle on the horizontal floor or table of the instrument, immediately in front of the keys. Each key is connected by a lever with a little steel knob, which, when the key is pressed down by the finger, rises up through one of the holes. An arm, connected with a vertical shaft, sweeps over the twenty-eight holes. If a key marked with a particular letter be touched, the knob corresponding with this letter rises, the revolving arm passes over it, and for the instant closes the circuit, and allows an electrical impulse to be transmitted. This impulse, by arrangements which will be described in the printing apparatus, causes the particular letter to be recorded on a slip of paper in printer's ink. The instant the arm passes over the little raised knob the circuit is broken, and if the finger were held a hundredth part of a minute on the key, the hand would pass again over the knob, and the letter would be repeated. To prevent this the hand carries, after the portion of it which rides over the knob and completes the metallic contact which closes the electrical circuit, a little inclined plane, which throws the knob out of its position, so that the hand cannot pass over it on any future revolution after the first contact. This arrangement is rendered necessary to prevent the repetition of letters, on account of the extreme rapidity of the revolving arm and recording apparatus.

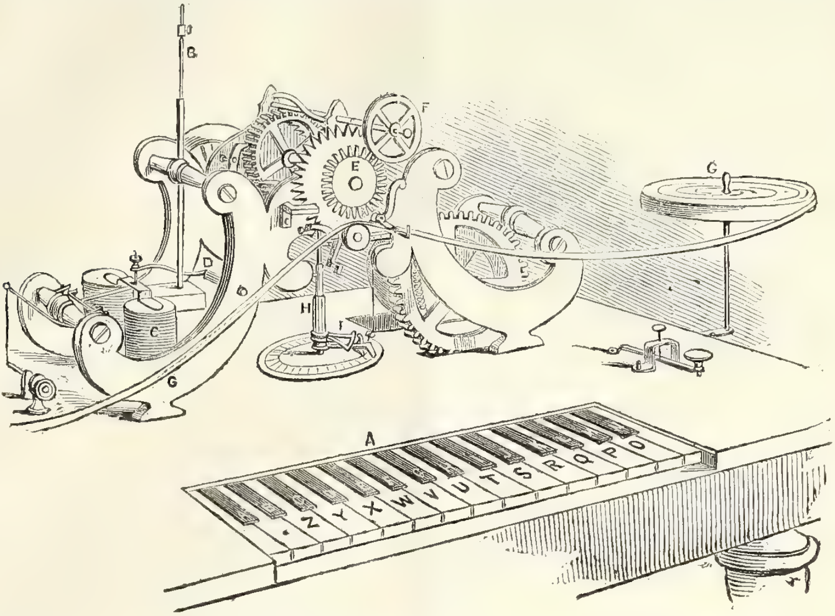
Printing Apparatus.

A shaft, which revolves seven times faster than the type-wheel, has a fly-wheel upon it to overcome the inertia of a small shaft which moves the printing press. This shaft is locked to the fly-wheel shaft by means of a clutch, which rests upon a small inclined plane. Whenever this clutch is kept upon the inclined plane, by means of a detent, the fly-wheel shaft revolves independantly of the small printing shaft; but as soon as the detent is moved by the action of the armature of the electro-magnet, the clutch locks both shafts together, and the small shaft is made to revolve one revolution, when the clutch again rests upon the inclined plane, which lifts it off the fly-wheel shaft. A cam is attached to one end of this shaft, which lifts the press and the paper upon which the message is to be printed against the type-wheel. The time of the locking of the shafts depends upon the arrival of the electrical wave, and thus, with two instruments in perfect harmony, the operator has the printing apparatus of the distant instrument as completely under his direction as the one before him. But to correct any minute variation in time between the instruments in circuit, there is a corrector, or wheel, attached to this shaft, with hook-shaped teeth, which mesh into corresponding cavities in the type-wheel. The latter being loose upon the shaft, or only held by friction, is removed backwards or forwards by the corrector to exactly the same position as the type-wheel on the instrument from which the message is being sent. This correction takes place in the act of printing every letter. There is also upon this shaft a cam, so arranged that, the moment the armature falls off the electro-magnet and opens the detent, it forces the detent up, and restores the armature to its original position upon the poles of the magnet.

Another new feature in this instrument, is its power of cutting off at will all offices except the one to which it is desired to communicate. This is accomplished by a flange on the type-wheel—this flange having a space cut out opposite a certain letter, and each office having the flange cut out at different letters from each other. A bolt is made to slide through the space, and moved through by the action of the instrument. If this bolt is sent through at the moment the space is opposite, it permits the instrument to run, if not, it goes against the flange and locks the type-wheel.

The operator, knowing at what letter a certain instrument will be unlocked, touches that key. This allows the instrument he wishes to communicate with to run; and he can send the message to that one, the other offices being unable to get it, as they would be locked, and could not bring their instruments into unison with the one sending the despatch. Thus, it is absolutely secret in its transmission, and, if necessary, anyone could send his own message, as it is only necessary, to insure its safe arrival, to touch the right keys, which are all lettered.

The electrical circuits are extremely simple. The earth-wire connects with the steel pins or knobs on the keys of the transmitting apparatus, and from the revolving arm through the electro magnet, and thence through the line and distant magnet to the earth. Reversed currents are not necessary, except on long submarine wires. There may be as many instruments in circuit as may be desired. The European news, consisting of about 3,000 words, by the arrival of each Transatlantic steamer, is transmitted by this instrument from Boston to New York, a circuit of about 300 miles, at the rate of 2,000 to 2,500 unabbreviated words an hour. There are 25 stations on the circuit which receive copies of the news, all of which are printed in plain Roman type by the Boston operator, all the instruments receiving the message at the same time, the receiving clerks at each station having simply to hand the copy as it arrives to the party entitled to receive it.



A. Key Board.
B. Vibrating Spring.
C. Electro-Magnet.

D. Detent.
E. Type-Wheel
F. Ink Roller.

G. Paper Printed upon.
H. Revolving Shaft.
I. Revolving Arm or Circuit Closer.

The mode of operating with this instrument is extremely simple, and easily acquired. The office desiring to transmit a message calls the station by touching the keys in a pre-arranged order, the distant office at once returns the signal " O.K.," or all right. The manipulator then commences the message, first striking the zero key to start the distant type-wheel in unison with his own. If the message is received correctly he is allowed to finish, and then the operator at the distant office gives the return signal of all right; if there is a mistake the receiving office touches his key board, which throws extra letters to the transmitting station, and he then commences again from the point where he made a mistake. There can be no mistake, however, if the operator touches the right key, and manipulators become so expert that they seldom touch the wrong one; if they do, the error is shown by the copy of the message on their own instrument, and immediately corrected.

If I have succeeded in conveying a clear and intelligible impression of the principle of the Hughes' system, it may be proper to invite your attention to what appear to me to be natural deductions.

Accuracy is secured by unerring mechanical laws, and not by the skill of the operator, as in the needle or Morse systems. Not only this, but in all other systems, if one of the symbols be missing, another letter is formed by the remaining symbols. *Rapidity* is secured by reducing the labour to its minimum. A single touch of a key prints the letter, instead of three or four vibrations of a needle, or a similar number of motions of a key, as in the formation of symbols to represent letters. Accuracy and rapidity being thus secured, ease and simplicity of manipulation must of necessity follow, and, consequently, the young operator readily acquires his or her education. The instrument, however, is specially adapted to females.

The one-wave system is specially important on long submarine circuits, where electrical impulses are limited, one wave being sufficient for a letter instead of five. Great difficulty has been experienced on long cables by the variation of time in the transit of the wave. By this correct timing instrument, simple and perfect compensation is mechanically attained for any length of wire or extent of variation. The sensitiveness of the magnet also enables this instrument to record more waves upon a long circuit than any I have yet met with. The rapidity of an instrument, however, does not consist only in the fact of its extreme sensitiveness, but also in its power to free itself from the influence of a current so soon as the effect of the current has caused the instrument to record the signal or letter sent. This property, attained by the electrical and mechanical combination of scientific laws, embodied in the design and construction of the instrument, and demonstrated by the results produced, must in time remove all doubt of its superiority, while its English tongue represented in plain printed Roman characters, will tend to make it the favourite of the Anglo-Saxon race.

DISCUSSION.

The Chairman said, in inviting discussion and further inquiry into this interesting subject, he would call the attention of the meeting to one or two points which he thought worthy of observation. The idea of the introduction of this self-curing material was perfectly original, and, as an invention, was very beautiful; but practical men would require it to be put to a very severe test before they adopted it. He believed it to be quite within the range of possibility to introduce a sufficient quantity of that viscid material into a telegraph cable, to effect the purpose which they had seen illustrated upon a small scale that evening, in a manner that must have been highly satisfactory to all present. If a fracture took place in the gutta percha covering at the bottom of the ocean, the cure would be effected without the fact of the rupture ever being known, as it would immediately heal itself. The novelty of this discovery, and its application to such a purpose, was highly honourable to Professor Hughes. They must take it for granted that this semi-fluid was a good insulator; and, as it had the property of hardening upon coming into contact with the water, it was likely to become a most valuable adjunct to gutta percha, which was of a porous nature, and liable to injury from fractures. He also thought the invention would be very valuable as applied to the street wires of electric telegraphs, and these afforded great facilities for testing its value. The mode adopted by Professor Hughes for obtaining synchronism in his instrument was very beautiful and novel. Previous attempts in this direction, though repeatedly made, had hitherto not succeeded. With regard to the rapidity with which the signals could be recorded, it was stated in the paper, that the Trans-Atlantic intelligence was conveyed between Boston and New York at the rate of from 2000 to 2500 unabreviated words per hour, which was equal to about 40 words per minute. There was a point upon which it would be interesting to have some information. It was stated that any number of instruments could be used in the circuit, and that there was the power of cutting off the communication from all the instruments, except the one which was being addressed. Supposing the instruments at the two extremities of the circuit to be in communication; for a moment the intermediate circuit would be interrupted. Was there any movement which indicated to the clerks at the intermediate instruments, the fact that signals were passing through the entire circuit, and must not be disturbed.

Professor Hughes replied that that was so, and there was no fear of interruption from the intermediate instruments.

Mr. William Smith thought the experiments which Professor Hughes had shown of the restoration of the insulation should be tested under pressure, for, after all, the main question was to ascertain how it would behave under the pressure that was due to the depth of the ocean in which the cable was submerged. This might be done in a closed vessel with a force-pump. He thought there was no difficulty in producing a semi-fluid substance which would become solidified by the action of water; but the question was whether, if they covered the wire with this preparation, and then cut through the gutta percha, the pressure would not force the material through the opening and prevent its acting.

The Rev. Walter Mitchell had had the advantage of seeing this experiment tried in private, where it could be conducted with greater care and accuracy than in a public room, and the results were highly satisfactory.

Mr. Wm. Newton begged to ask whether there was any objection to stating what the nature of this viscid composition was? It would be interesting to the members to know.

Mr. Hyde replied that it would afford him great pleasure to furnish as much information as possible on this subject; but in almost every invention there were certain things which it was expedient to keep to themselves. He would add, with reference to these instruments generally, that there were many things which he might communicate if he could do so in justice to the rights and claims of the inventor. Unfortunately people did not recognise, as he thought they ought to do, the rights of property in inventions, and for that reason inventors were obliged to keep some things to themselves.

Mr. Newton added that Professor Hughes had protected his invention by letters patent; and in his specification he was bound to state, not only in what the invention consisted, but also the means by which he proposed to carry it into effect; and when the specification was enrolled, the inventor must give the full details of it. He would say with regard to this insulation, it had been known for some time in the United States, and he had seen observations in the public prints detracting from its merits. He alluded to that in order to observe that, as far as he could judge, those statements were erroneous, and instead of the invention being valueless, it had been properly designated as an exceedingly ingenious mode of insulating the electric conductor. He agreed with the opinion expressed that it was advisable to make experiments in order to ascertain the manner in which this insulating compound would act under considerable pressure. With regard to the Atlantic cable, he had never had any confidence in it. It appeared to him that any metallic coating on the outside must have some effect upon the conductor inside, especially when the conductor was only protected—as in the case of the Atlantic cable—by an imperfect insulator like gutta percha. Mr. Hyde had stated that gutta percha was a good insulator—a remark which he (Mr. Newton) was surprised to hear from one so well qualified to judge of these matters, because it was generally conceded that gutta percha was only a moderately good insulator. India-rubber was much better than gutta percha, which had the peculiar property of becoming charged with electricity after it had been used as an insulator for any length of time, and was therefore likely to induce leakage. He could mention one or two other modes of insulation which he considered preferable to that of gutta percha, and particularly he would notice the invention of Captains Drayson and Binney of the Royal Engineers. They proposed, instead of a strand of seven wires, to have a single large conductor, and to cover that with a solution of india-rubber paid round with silk or some other non-conducting substance, and to enclose the whole in a vulcanised india-rubber tube which contained a column of air. In a conductor upon that principle they had, in the first place, the insulation of the india-rubber; secondly, the insulation of the silk; thirdly, that of the air, and finally that of the outer india-rubber tube. This appeared to him to form a perfect insulator of the electric wire. There were other insulating compositions which had come under his notice professionally, one of which was that of Mr. Leonard Wray, who proposed to make a composition formed of india-rubber or gutta percha, mixed with siliceous matter, and a resinous substance, such as shell-lac. This appeared to him to contain all the elements of a good insulator. He was not, however, aware that this plan had been tested to any great extent. Another method had been introduced by Mr. Macintosh, but he did not consider it so practical as the others to which he had alluded.

Mr. Hobbs remarked that there was novelty in the idea of the material being forced out by the pressure of the water, as stated by some of the speakers. If there was a hole through the gutta percha, he apprehended the pressure on the hole would be the same as the pressure on any portion of the cable, and he could not conceive how, under such circumstances the semi-fluid matter was to be forced out.

Mr. Newton would add with reference to the remarks of the chairman, that this plan would be applicable to underground telegraph wires—that it appeared to him (Mr. Newton), to require the action of water to solidify the viscid fluid, and, as far as he understood, it would not harden by simple exposure to the air.

The Chairman replied that a simple wound in the gutta percha covering would not be injurious to insulation in a land telegraph wire. The injurious effect would only take place in the event of water getting into the pipe. The moment the wound in the gutta percha rendered the insulation imperfect, the water would have the effect of healing the wound by its action on the viscid fluid.

Mr. **Thomas Winkworth** would take the liberty of asking one or two questions. Should any fractures occur in the cable, what provision was made for the fresh supply of the semi-viscid fluid which exuded or oozed out?

The **Chairman.**—When it is exhausted you cannot put in a fresh supply.

Professor Hughes explained that there would be no more fluid exuded than was sufficient to fill up the space which was cut out. If they cut the gutta percha in the open air, no more fluid would ooze out than would be enough to fill the space, and therefore the quantity in the tube would be sufficient to fill up an innumerable number of small fractures.

The **Chairman**—Does the fluid harden by exposure to the air?

Professor Hughes—No; but it could be easily made to do so.

The **Chairman** was still of opinion that it would be valuable as applied to land telegraph communication. He would inquire whether the application of the semi-fluid matter was very expensive?

Professor **Hughes** replied that the cost was something below that of gutta percha. It could be placed within two coatings, or between the wire and the single outer coating.

Mr. **Hobbs** would ask what effect time would have upon this material? The substance might be very good when first applied, but in time its properties might be destroyed.

Mr. **Hyde** replied that time must answer that question. He was not able to do so at present.

Professor **Hughes** said it had been tried under water for three months, and had been exposed to the atmosphere for six months, without any change whatever having taken place. It was not injured by the action of the atmosphere.

Mr. **Winkworth** would further inquire whether the printing instrument was in practical use for any great length of land wire, and on what length of circuits it had been worked?

Professor **Hughes** said it was in practical use in the United States on six telegraphic lines when he left America, and that it had been worked over a circuit of 600 miles without relay. The right to use the instrument had been purchased by companies possessing 30,000 miles of telegraph in America.

Mr. **Winkworth** would like to be informed whether the instrument had been tried upon submarine wires; and if so to what extent in length, and with what rapidity?

Professor **Hughes** said it had been worked upon the Atlantic cable while coiled at Keyham, and also upon the Red Sea and Australian cables, through their entire length.

The **Chairman** inquired whether those experiments had taken place in the presence of witnesses.

Professor **Hughes** said they were witnessed by several persons.

The **Chairman** added that it was satisfactory that Professor Hughes was able to state that the experiments were witnessed by several persons, as he was not aware that that fact had ever before been published. It was gratifying to know that messages were passed through the entire distance.

Mr. **Hyde** stated that the experiments were continued for several weeks during the shipping of the Atlantic cable at Keyham in May last. The transmission of messages through the Atlantic cable was at that time slow, and at a much less rate than the instrument would be capable of accomplishing at the present time. Professor Hughes had made no experiments upon long submarine lines until he came to this country, and the first experiments were made upon the Atlantic cable. The instruments were timing instruments, and the rate of speed must be proportioned to the rate at which the electric wave would travel through the wire. When he was in America, he learnt from the electrician's report to the Company that the rate at which the eletric wave would travel through the Atlantic cable was equal to four words per minute with the ordinary Morse relay. The instrument of Professor Hughes, intended for land lines, would not move correctly at this slow rate, and therefore instruments were specially made with a minimum rate of speed of four words per minute, in accordance with the electrician's report. When Professor Hughes arrived at Keyham, he found that the rate at which signals could be transmitted through the Atlantic cable was less than had been stated in the report, and the instrument was not adapted to so slow a motion. After reducing it by temporary arrangements, he was able to transmit letters at the rate of two and a half words per minute. This was done in the presence of Mr. Field, the managing director, and some half-dozen other persons. Since that time the instrument had been tried upon the Tasmanian cable, 240 miles in length, and through that they worked 25 words per minute. Subsequently, experiments were made upon the Red Sea cable, 1780 nautical miles in length, or nearly 2000 statute miles. Upon that cable they worked with perfect success, day after day, for a week, first upon 500 miles, then upon 800, then upon 1500, and finally upon the whole length of 2,000 miles. The rate of speed through the entire length was between four and six words per minute. The rate over 1000 miles was from eight to ten words per minute; through 500 miles it was twenty words per minute. With reference to the semi-fluid substance, he had no desire to keep back any useful information, but they had been trying experiments for four months, in order to ascertain what combination of materials was best adapted for the purpose. Mr. Newton had referred to a cable constructed with a long tube filled with air as a non-conducting element. It appeared to him (Mr. Hyde) that as an insulator the air would be far inferior to the fluid substance, or even to gutta percha. He also thought that if any fracture occurred in the coating, the pressure upon it would be such that the air would be displaced by the water. On the other hand, Professor Hughes had been seeking and had obtained a semi-fluid substance, every portion of the ingredients of which would be heavier than water. He would say with reference to the semi-fluid substance, that almost anything would make a semi-fluid substance. The question was—what was the best material, and this he did not feel disposed at present to develop. He would only say that ordinary oil or hydro carbons mixed with resinous substances would produce such a semi-fluid substance as would restore insulation. The merit of the invention consisted in the idea of the use of a semi-fluid material for this purpose and not so much in the material used. Mr. Smith had suggested that means should be taken to test the action of this material under heavy pressure. His (Mr. Hyde's) impression always had been that the pressure would be equal upon all parts of a submerged cable, and therefore the fluid would be in the same position under a pressure of two miles depth of water as under two feet in a bath. They had, however, gone almost to the extent proposed by Mr. Smith. They had made the experiment with a pressure equal to that of 3,000 fathoms, or two miles, with perfect success, with the gutta percha incised before it was submerged. In one case the gutta percha was split from end to end and it came out perfect.

Mr. **Bevan** referred to the recent experiments upon insulation made at the works of Messrs. Silver and Co., at North Woolwich. As far as he understood it, the insulation was effected by india-rubber, and if a puncture occurred in the tube it would by the pressure be healed. Some credit was therefore due to the plan as being prior to that of Professor Hughes.

Mr. Newton said experiments as to the effect of pressure had been tried with the cable as designed by Capt. Drayson, and it was found that with a pressure exceeding that of two miles below the surface, a puncture being made in the tube, the air was not expelled from it. In the case of a small fracture, such as a crack, it did not appear that the air escaped even when under hydraulic pressure.

Mr. Hyde was very glad to hear it; he thanked Mr. Newton for having mentioned the different modes of insulation that had come under his notice. He (Mr. Hyde), however, was not there for the purpose of criticising the inventions of others, but to illustrate and defend those of Professor Hughes.

Mr. Smith said the question was, whether the material would exude from the tube, when cut whilst under pressure; he knew that in some experiments that were tried the fluid did exude. The cut was made whilst under pressure, and there was no balancing of the forces until some of the fluid had exuded, and some alteration in the dimensions had taken place.

Mr. Tuckett submitted that upon the principle of hydraulic pressure if the surface of the whole tube were greater than the surface which was not protected, the pressure being in proportion to the area, there must be exudation, and there would be a tendency to press the liquid out of the hole.

Mr. J. G. Appold, F.R.S., said, experiments showed that there was no exudation. It made no difference whether it was under pressure or otherwise.

Mr. Hyde, to meet the hydraulic point that had been raised, would ask whether the pressure upon each point would not be the same? To get the fluid to ooze out, they must have a point free from pressure. The pressure was equal on all parts of the cable.

The Chairman said, this point had been proved by experiment.

Professor Hughes remarked that the fluid, being heavier than water, was not displaced by the water.

The Chairman would wind up this discussion with a few observations, one being not so much applicable to telegraphic communication as to the objects and action of this society. When he first joined the Society, about 24 years ago, before the revolution in its operations took place—for it was more than a reformation—no patent scheme could be brought before the society. It must have been an invention thrown open to the world. The revolution to which he had alluded, brought about a great change in this respect; and he thought one of the greatest boons the society now conferred, was the encouragement it gave to patentees to come with their inventions as soon as they were in a condition to do so, and allow them, as had been done by Professor Hughes and Mr. Hyde that night, to give them such information as they could, without injury to their interests. Mr. Newton had a perfect right to ask for the information he was desirous to obtain; but, at the same time, there was no improper selfishness in Mr. Hyde refusing to communicate it; he had a perfect right, if he chose, to keep the secret to himself. The application of india-rubber for the purpose of insulation was not new, it had been used in single, double, and treble coats for the last 20 years. The great improvement consisted in thoroughly uniting the edges of the india-rubber by means which would not injure it in its non-conducting character, or lead to the ultimate decomposition of the material itself. The solutions formerly employed for the purpose were injurious to it; and he was happy to say there were two or three plans then under consideration which gave good promise of success. These, however, had nothing to do with the beautiful idea of placing within the gutta percha a material capable of healing those wounds which arose from the defects existing more or less in all impure gutta percha—such as air bubbles, small particles of fibres, or wood, or indeed from any defect whatever. He was sure he was only expressing the feelings of the meeting in proposing a vote of thanks to Mr. Hyde for the paper he had read, and also to Professor Hughes for the illustrations he had given of his beautiful apparatus, and the explanations he had afforded upon this very interesting subject.

A vote of thanks was then passed to Mr. Hyde and Professor Hughes.

The Secretary announced that on Wednesday next, the 20th instant, there would be NO MEETING of the Society, and that on Wednesday, the 27th instant, a Paper by Mr. John Arthur Phillips, "On the Metallurgy of Lead," would be read.

Home Correspondence.

SOCIETY OF ARTS' EXAMINATIONS.

Sir,—If the Examinations of the Society of Arts are ever to become a great fact, extending from year to year in efficiency as a practical stimulus to the educational efforts of the great bulk of the community, and proving its value by the extent of its operations, they must be placed upon a basis more systematic than at present appears to be the case. It is true that numerous Local Boards have been formed, that numbers of candidates for prizes and certificates have shown their appreciation of the advantages offered to them, and that really substantial benefits have accrued to many, who, without this aid, might never have had the means of raising themselves. But, yet for all this, it can be shown that in localities where it might have been supposed a knowledge of such opportunities being open to our young men would have been generally diffused, little is comparatively known, and that by far the greatest amount of the exertions used are practically thrown away.

Much of this is no doubt owing to the want of sufficient publicity, to the difficulty of bringing home the beneficial nature of the Examinations to the minds of the great majority, and the want of information as to the means of taking advantage of them. Something also is owing to the want of a permanent character to the Local Boards, and that absence of unity of purpose and action which is so indispensable to success. Instead of each Institution in association with the Society of Arts being permitted to form a Board of Examiners, irrespective of others, it would, I believe, be advisable for a permanent Board to be formed in every principal town throughout the kingdom, to be specially recognised by the central body in London, and to be a source for information and guidance to every one within reach of its influence. It is one of the evils attaching to the rejection of the personal attendance of Examiners from London that too much is left for local effort, and though any more direct supervision might interfere with independence of action, it would at least conduce to more practical efficiency. Without, however, reverting to previous decisions which may be left to some future opportunity, it may be worthy of consideration whether a change in the form of appointing Local Boards of Examiners might not be adopted with advantage.

Another important point for consideration is the preparation of candidates for Examination, and this more immediately concerns the managers of Mechanics' Institutes. Wherever the duties of a managing committee are well performed they prove successful, but unfortunately too many deem the performance of the duties irksome, and leave all to the secretary, who, whatever may be his zeal and ability, is rarely equal to the whole task imposed on him, and who, perhaps, in the majority of cases, leaves much undone, and the Institute is comparatively a failure, the public lamenting that there should be so little desire for mental improvement.

To remedy this state of things, it is, in the first place, indispensable that those who undertake the duties of a managing committee should resolutely set about the fulfilment of them. They should not be cast down by discouragements, nor relax their exertions by apparent failures; no feeling of despondency should be admitted, but, with a cheerful and hopeful spirit, they should persevere, and always be buoyed by the conviction that success is certain if the means be diligently employed. Their reward will be in the improvement of the community in which they dwell, in the moral and social welfare of their neighbours and dependents, and the consciousness of duty well performed. Their labours will not always be appreciated, nor their offers of aid responded to, but this should be an inducement to increase their exertions, for where the desire for knowledge is the least, the necessity for it is the greatest.

In most Mechanics' Institutes the major part of the instruction imparted is of an elementary character, and such classes furnish no candidates for the Examinations of the Society of Arts; but they require a similar aid, and this might be afforded by periodical examinations and the award of small prizes for proficiency. Such classes prove valuable as preparatory to the more important ones, and where the pupils have shown, by the examinations, their knowledge of the elements of instruction, their labours should be directed to specific branches, with especial reference to their becoming candidates for the certificates of the Society of Arts. To render this, however, more appreciable, it would be as well if the plan of the examinations, the subjects selected, the certificates awarded on previous occasions, the substantial advantages obtained by successful candidates (of which there are numerous instances), and the mode of procedure, were printed on a sheet, and conspicuously exhibited in the reading-room and class-rooms of every Mechanics' Institute in the Kingdom, whether associated with the Society of Arts or not.

In this county the Institutes have the advantage of the Yorkshire Union, which omits no opportunity of disseminating information on every subject of interest to them, but the majority of other Institutes possess no such efficient organisation. They are left therefore to individual effort, which, however well intentioned, is not always the most efficacious, and the consequence is that praiseworthy labours fail in their effect, and a scheme which is capable of proving a mighty engine in the elevation of the great majority of our population, performs but a small portion of its work. Every article for sale, whether a quack medicine or blacking, has been extensively and continually advertised before it has come into general consumption, and though education may assume a higher ground, it yet requires publicity and its advantages to be made known with continuous exertion.

In a letter which appeared in a former number of the *Journal*, Mr. Buckmaster, who has done good service in the cause of education, advocates the more general adoption of free circulating libraries as a means of promoting the dissemination of knowledge. I believe it would have a contrary effect. It is a common practice to value an article by the cost of it, and those who could obtain books gratuitously would value them accordingly. The majority of readers would be those who now either purchase cheap books or subscribe to circulating libraries; and I believe few, if any, would be tempted to read, from the mere fact that they could do so without paying for it. Again, many Institutes are indebted to their libraries for the means of continuing their educational efforts. Without the aid of the subscriptions of those who use only the library and reading-room they would be unable to continue their classes for instruction, and I might cite Sheffield as a case in point, where the establishment of a free library has helped, with the local rating of the Institute, to cause almost, if not quite, its extinction. Class fees are usually found insufficient for inevitable expenses, and wherever an Institution has been made self-supporting it is principally owing to the subscriptions obtained from those who use the library.—I am, &c.,

BARNETT BLAKE.

Leeds, 29th March, 1859.

PRODUCTS OF THE COMBUSTION OF COAL GAS.

Sir,—I am sorry to trouble you with another letter on this subject, but I promise you it is my last; and I feel that an apology is necessary, not only because the matter has been already fully discussed, but because the letter of your correspondent, Mr. Evans, in the last number of the *Journal*, is so singularly inconsistent and illogical that it really does not require an answer.

Mr. Evans is a gas manufacturer, and he assures you that it is the wish of all gas companies to discover a means of abstracting the sulphur which remains in the purified gas; and he adds that I should be doing a service if, as a chemist, I could devise some plan for effecting it. Now I regard this as a full admission that the sulphur of gas is known to be objectionable, and yet Mr. Evans does not know how it can be injurious; for, in spite of well-known chemical laws, he has not yet succeeded in getting a drop of oil of vitriol from the sulphur of burning gas, notwithstanding that he has tried every possible way for the last five years. Let me add to this his admission that, in order to ascertain roughly the amount of sulphur compounds in coal gas, we must use ammonia to fix the sulphurous acid, and chemists will see the dilemma in which Mr. Evans is placed.

But, apart from all criticism, there is a simple means whereby Mr. Evans may test his conclusions. If he will burn gas in the ordinary way from an argand burner, under a large glass vessel containing water, he will see the acid in the outside of the vessel, and will soon obtain enough oil of vitriol to satisfy every doubt, notwithstanding that the acid thus collected is but a fraction of that which is ultimately formed.

As to Mr. Evans' comments on my expression *raw* gas, they are in no way connected with the matter at issue—although I might say that the term is perfectly applicable to gas that has not been purified by other means than the condenser, for it was in this sense I used it; and as for the numbers, they are not mine, but Mr. Wright's. I am, &c.,

H. LETHEBY.

London Hospital, April 8th, 1859.

MR. VARLEY'S PAPER ON THE ELECTRIC TELEGRAPH.

Sir,—In the *Journal of the Society of Arts* dated April 1st, in the discussion on a paper on submarine telegraphy, I find it stated by Mr. Cromwell Varley, that without Professor Thompson's Reflecting Galvanometer, the Atlantic cable would never have transmitted a single message. The fact is, however, that the whole of the signals sent from the "Agamemnon" to the "Niagara," and from Valentia to Newfoundland, were received and indicated by a galvanometer made by me for the Atlantic Telegraph Company; a simple, single needle, made very delicate, and exceedingly sensitive, but not possessing the almost microscopic proportions of the beautiful instrument of Professor Thompson. I have more than one competent authority for this statement, but it is only necessary to mention the name of Mr. Charles Victor De Sauty, Chief Electrical Superintendant at Newfoundland, and whose words I have permission to quote. They were in substance as follows:—"If it will be of any use or satisfaction to you, I beg to inform you that one of your galvanometers was used all through the laying down of the cable, and was the only instrument upon which we received messsages and signals at Newfoundland, and you have my full consent to use my name as an authority."

My objects in asking you to publish this communication are, in the first place, to show Mr. Varley his error, and to give a fair estimate of the capabilities of the cable while it remained intact; and in the second place, in justice to myself as a manufacturer of telegraph instruments in general, and of that galvanometer in particular. It may be as well also to state that I received the information from Mr. De Sauty in the beginning of March, and it was merely intended as a testimonial of good workmanship. The galvanometer in question is now the property of Mr. de Sauty, having been presented to that gentleman by the directors, as a momento of the event. I am, &c.,

HENRY MOORE.

Spa-house, Lloyd's-row, Clerkenwell.

THE ROCKET GUN.

Sir,—The great attention now very properly directed towards the improvement of projectiles seems to have left the cannon completely in the rear; in fact, no ordnance is capable of throwing the enormous shot now proposed to be used without destruction at the first discharge; and it is evidently desirable to throw still larger than any now proposed—if cannon could be found to withstand the terrible concussion. Such being the fact, it would appear that we have hitherto been making a great mistake, and, instead of propelling the shot from the cannon, we should project the cannon from the shot. With the view of solving this enigma, I have made some very successful experiments with a "Rocket Gun," upon which a new system of artillery may be founded, far more economical than any now in use, and infinitely more destructive. It combines the utmost rapidity of firing, with perfect safety to the gunners, without the miserable expedient of breech-loading, and is equally adapted to the musket bore, the ten-inch gun, or twice that diameter, if such should be required.

A ten-inch "Rocket Gun" consists principally of a core or cylindrical pin of cast iron—say, about six feet long, connected at the base with a large mass of metal, mounted on trunnions, as usual. The projectile, in shape, resembles the iron case of a Congreve rocket, and is cast with a ten-inch bore, so as to slide easily on the pin. That bore is charged and wadded with the proper weight of powder, and the pointed head may either be solid, of any weight, or cast with an additional conical chamber and fuse-hole, to receive a bursting charge of powder, liquid fire, or any other combustible of still more destructive power. For siege use no boring will be necessary, but when accuracy of aim may be required, the pin must be turned—an operation of no difficulty whatever—and the short tail of the projectile slightly cleaned out after casting, in order to ensure a tolerable fit. Rifling, as in the Lancaster gun, or by common grooving, may also be introduced; but the terrible shower of projectiles which a single "Rocket Gun" is capable of throwing, will render that operation quite unnecessary.

Rapidity of fire is, of course, obtained, because every projectile carries its own charge and touch-hole, while the gunner has only to slip it on to the pin by hand, or with a crane, if of large size, to prime and fire.

I shall be happy to exhibit the operation and effects of a musket-bore "Rocket Gun" to any one interested in such matters.

HENRY W. REVELEY.

Poole, Dorset, March 26.

Proceedings of Institutions.

◆

London Mechanics' Institution.—The following letter has been received by Mr. T. J. Pearsall from Lord Brougham:—"Sir,—I have received your letter, stating that a meeting is to be held on behalf of the London Mechanics' Institution, and I need hardly assure you how convinced I am of the importance of this proceeding. The greatest misapprehensions have prevailed respecting the history of that Institution; and its inestimable services to the improvement of the working classes have been of late years overlooked, or undervalued, as well as the benefits which its continued exertions are still capable of bestowing. It is therefore to be hoped that the difficulties under which it at present labours may be removed by the contemplated proceeding. I lament exceedingly that I can do little more than give my good wishes to this good work, but my means are very limited, and the demands upon them have no limit whatever. Such a meeting as you announce can never be held without bearing in grateful remembrance the founder of the Institution; and they who question Dr. Birkbeck's claims to this great distinction, have only been able to state that others had some months before broached the idea of such a plan. But 20 or 30 years before, he had laid the foundation of all that has since been done by delivering a course of lectures to working men, so that the great step must be regarded as having been made by him at the beginning of the century, and not in 1823, when he both founded and endowed the London Institution."

MEETINGS FOR THE ENSUING WEEK.

Mon. ......London Inst., 7. Mr. John Ella, "On Chamber, Orchestral, and Ballet Music."
Medical, 8.
Tues. ......Syro-Egyptian, 7½. Anniversary.
Civil Engineers, 8. Mr. W. J. Kingsbury, "Description of the Entrance and Entrance Lock of the Victoria (London) Docks, with a detailed Account of the Wrought-iron Gates and Caisson, and Remarks upon the Forms adopted in their construction."
Statistical, 8. Mr. Danson, "On a Method of Relieving the Density of Town Populations."
Pathologcal, 8.
Wed. ......Royal Soc. Literature, 4. Anniversary.
London Inst., 7. Conversazione.
Geological, 8½. 1. Prof. Owen, "On some Reptilian Remains from South Africa." 2. Mr. E. Hull, "On the South-Easterly Thinning-out of the Lower Secondary Rocks of England."
Ethnological, 8½.
Thurs .....Linnæan, 8. 1. Dr. Griffith. "On *Gnetaceæ*." 2. Dr. Seemann, "Synopsis of *Camellia* and *Thea*."
Chemical, 8. 1. Dr. Roscoe, "On the Absorption by Water of Chlorhydric Acid and Ammonia." 2. Dr. Debus "On Polyatomic Alcohols."
Sat. ......Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

◆

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 9th March, 1859.

4. Bill—Affidavits by Commission, &c.
French Emigration Scheme—Correspondence.

Delivered on 10th March, 1859.

50. Local Acts (38, Ipswich (Borough) Fishery); 39, North and South London Junction Railways—Admiralty Reports.
80. Harbours, &c., Bills (14, Mersey Dock and Harbour)—Board of Trade Report.
102. Education Grants (Scotland)—Returns.
104. Portpatrick and Donaghadee Harbour—Return.
Harbour of Refuge—Report of the Commissioners.
British Columbia—Papers, Part I.

Delivered on 11th March, 1859.

4. (1.) Church Rates—Supplemental Return (a Corrected Copy).
6. Railway and Canal Bills (140, Warrington and Stockport Railway)—Board of Trade Report.
106. Court for Divorce and Matrimonial Causes—Return.
113. Houses, &c.—Return.
118. Poor Rates—Return.
119. Fishery, Piers, and Harbours (Ireland)—Return.
63. Bills—Highways (amended).
65. ,, Poor Relief (Ireland) Acts Amendment.
66. ,, Combination of Workmen.
69. ,, Oaths Act Amendment.

Delivered on 12th and 14th March, 1859.

19. Lunatics—Return.
61. Works and Public Buildings—Abstract Accounts.
110. East India (Oude Proclamation)—Return.
112. Population, &c., of Parishes—Return.
120. Enfield Establishment—Return.

70. Bills—Municipal Elections (as Amended in Committee and on Re-commitment).
71. Bills—Law of Property and Trustees Relief Amendment (amended).
60. Bills—Public Offices Extension.
61. ,, Court of Probate, &c. (Acquisition of Site).
67. ,, Law Ascertainment.
68. ,, Registration of Births, &c. (Ireland).
Poor Relief (Scotland)—13th Report of the Board of Supervision.

Delivered on March 15th, 1859.

6. Railway and Canal Bills (141. London Bridge and Charing Cross Railway; 42. Londonderry and Lough Swilley Railways; 143. Llyfni Vale Railway; 144. South Yorkshire Railway and River Dun Company; 145. Waveney Valley Railway; 146. West London Railway)—Board of Trade Reports.
50. Local Acts (40. Tyne Improvement; 41. Wear Navigation and Sunderland Docks; 42. Londonderry Bridge; 43. King's Lynn Borough and Port and Harbour Improvement)—Admiralty Report.
72. Bill—Eaton and Welton Exchange.

Delivered on 16th March, 1859.

6. Railway and Canal Bills (147. Lancashire and Yorkshire and East Lancashire Railway Companies)—Board of Trade Report.
80. Harbour, &c., Bills (15. Thames Watermen and Lightermen)—Board of Trade Report.
126. British Museum—Return.
129. Chelsea New Bridge—Return.
73. Bill—Saint James Baldersley Marriages Validity.
Church Estates Commissioners—8th General Report.
Ecclesiastical Commissioners for England—11th General Report.

Delivered on 17th March, 1859.

117. Hops, &c.—Returns.
128. Revenue Departments—Estimates.
130. Tonnage and Pilots (London)—Returns.
137. Seamen Deserted—Returns.

Delivered on 18th March, 1859.

6. Railway and Canal Bills (148. Londonderry Bridge)—Board of Trade Report.
121. Population, &c.—Return.
122. Woods and Forests, &c.—Return.
123. Property and Income Tax—Return.
126. (1.) British Museum—Plan referred to in No. 126.
134. Army (General Officers)—Return.
135. Chaplains, &c. (Army)—Return.
136. Foreign Office—Copy of the Report of Mr. John Phipps.

Delivered on 19th and 21st March.

116. Coal—Copy of the Report of Messrs. Miller and Taplin.
121. Population, &c.—Return (a corrected copy).
124. Duchy of Lancaster—Account.
132. East India (Governor General)—Copy of a Despatch.
50. Local Acts (44, Kingston-upon-Hull Docks)—Admiralty Report.
139. Malt—Account.
144. Immigrants and Liberated Africans—Return.
75. Bills—Municipal Elections (as amended in Committee on recommitment and on consideration of Bill, as amended).
76. ,, Ecclesiastical Courts and Registries (Ireland.)
77. ,, Elections, &c. (amended).
78. ,, Nottingham Charities.
79. ,, Galway Harbour and Port Act (1853) Amendment (Ireland).
80. ,, Savings Banks (Ireland) Act Continuance.

Delivered on 22nd March, 1869.

125. East India (Mr. Hudson, &c.)—Correspondence, &c.
131. East India (Mortality at Dumdum)—Reports and Correspondence.
138. Postal, &c., Communication (England and Ireland)—Returns.
140. Electors—Return.
141. Constituencies—Return.
145. Registered Electors (Marylebone)—Return.
74. Bills—Tramways (Ireland) (amended).
81. ,, Admiralty Court.
82. ,, Charitable Uses.
85. ,, Petitions of Right (amended).
Ordnance Survey, &c.—Report of the Progress thereof.

Delivered on 23rd March, 1859.

50. Local Acts (38, Ipswich (Borough) Fishery)—Admiralty Report (a corrected copy).
100. Public Income and Expenditure—Returns.
146. British Columbia—Returns.
83. Bills—Parliamentary Voters (Ireland).
87. ,, Patents for Inventions (Munitions of War).
88. ,, Lunacy Regulation Act (1853) Amendment.
89. ,, Common Rights, &c. (War Department).

Delivered on 24th March, 1859.

107. Galway Harbour—Copy of Report.
149. War Department—Return.
84. Bills—Sale of Poisons (amended).
90. ,, Debtor and Creditor.

Delivered on 25th March, 1859.

50. Local Acts (45, Greenwich and South Eastern Docks) Admiralty Report.
150. Deserted Children (Ireland)—Return.
153. Population, &c.—Return.
155. Queen Anne's Bounty—Account.
93. Bill—Titles to Land (Scotland).

Delivered on 26th and 28th March, 1859.

68. (2) Trade and Navigation Accounts (February 28, 1859).
151. Deserted Children (Ireland)—Return.
92. East India (Railways)—Return.
142. Chronometers—Return.
163. Committee of Selection—3rd Report.
140. Electors—Return (a corrected copy).
Manning the Navy—Report of the Commissioners and Minutes of Evidence.

Delivered on 29th March, 1859.

50. Local Acts (46, Lymington Railway; 47, Thames Waterman and Lightermen)—Admiralty Reports.
147. Lunatic Asylums (Ireland)—Copy of a Letter.
148. National Education (Ireland)—Returns.
154. East India (Native Worship, &c.)—Copy of Despatch.
159. Population, Revenue, &c.—Return.

Delivered on 30th March, 1859.

152. Highland Roads and Bridges—45th Report of Commissioners.
156. Universities (Scotland)—Copies of Two Ordinances.
161. Landed Estates Court (Ireland)—Return.
92. Bill—Weights and Measures Act Amendment.

Delivered on 31st March, 1859.

158. Militia—Return.
86. Bills—County Prisons (Ireland) (amended).
91. ,, Poor Law and Medical Charities (Ireland).

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 8, 1859.]

Dated 1st March, 1859.

536. E. J. Hughes, 123, Chancery-lane—Imp. in preserving animal food, poultry, game, fish, fruit, and other similar substances. (A com.)

Dated 12th March, 1859.

634. J. Palmer, Sutton Coldfield, Warwickshire—A new or improved trap for catching animals, birds, and fishes.

Dated 16th March, 1859.

660. I. Ash, 17, Great Bridport-street, Blandford-square, Middlesex—Imp. in the construction of locks and latches.
664. W. Avery, Birmingham—Imp. in machinery for the manufacture of screws.
668. J. Clark, Newton Heath, near Manchester—Imp. in the manufacture of fabrics in which compounds containing india rubber are used.
670. H. Bessemer, Queen-street-place, New Cannon-street—Imp. in the manufacture of crank axles.

Dated 17th March, 1859.

672. C. Defries, Houndsditch—Imp. in lamps.
674. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for folding and stiching sheets of paper. (A com.)
678. A. G. Hutchinson, West Derby, Lancashire—Imp. for counteracting damp in buildings.

Dated 18th March, 1859.

684. W. B. Taylor, Ballymena, Antrim, Ireland—Certain imp. in or applicable to looms for weaving.
690. R. Mushet, Coleford, Gloucestershire—A new or improved metallic alloy.
692. A. L. Thirion, Asche en Refail, province de Namur, Belgium—Imp. in water, wind, steam, and hand mills.
694. J. W. Duncan, Grove-end-road, St. John's-wood, and J. E. A. Gwynne, Hanover-terrace, Regent's-park—Imp. in, or connected with, apparatus for the generation, application, and condensation of steam, part of which apparatus or arrangements is applicable to other purposes.

Dated 19th March, 1859.

696. W. B. Gingell, 37, Corn-street, Bristol—Imp. in the form of metal bars used for the stiles, rails, heads, and sills of window sashes, casements, and other lights.
698. S. Stein, Chapel-place, Poultry—Manufacturing a resinous carton or pasteboard from vegetable matter, an imp. for roofing, ship sheathing, lining walls to prevent dampness, and other uses. (A com.)
702. J. Howden, and A. Morton, Glasgow—Imp. in apparatus for obtaining and regulating motive power.
704. W. and S. Pickstone, Radcliff bridge, near Manchester—An imp. in stiffening, sizing, filling, or weighting textile fabrics.
706. W. C. Cambridge, Bristol—An improved construction of chain harrow.

Dated 21st March, 1859.

708. A. Baucq, Marchiennes, France—Maintaining graters mechanically.
710. R. Whittaker, Lennox Mill, Stirling, N.B.—Imp. in the manufacture or construction of metallic rollers or cylinders and mandrills for printing.
712. J. Roberts, Staley-bridge, Chester—Imp. in packing for pistons.
714. J. Bickerton, Oldham—Imp. in opening and securing window sashes.
716. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin Tottenham, Middlesex—An improved compound or preparation of materials for, and mode of covering and insulating wires or conductors used for telegraphic or electrical purposes.

Dated 22nd March, 1859.

718. G. P. A. Lutz, Rue Ménars, Paris—An imp. in veils.
720. P. Tagliacozzo, 27, Broad-street-buildings—An imp. on metallic pens.
724. J. T. Pitman, 67, Gracechurch-street—Imp. in springs for railroad cars, and for other purposes. (A com.)
726. S. Newington, M.D., Ridgway, Ticehurst, Sussex—Imp. in apparatus for distributing seeds and manure.
728. W. P. Wilkins, Ipswich—Imp. in the arrangements of valves, and in their application to steam engines.
732. J. Tyssen, Rotterdam—An improved apparatus for indicating the speed of ships and other vessels.

Dated 23rd March, 1859.

735. S. Oram, 137, Fleet-street—Imp. in pipes or tubes for generating and superheating steam.
736. W. Adamson, Newcastle-on-Tyne—Imp. in apparatus for propelling vessels.
737. S. Clarke, Albany-street, Regent's-park—Imp. in the manufacture of candles.
738. W. Middleship, Grove-terrace, South-grove, Mile-end—Imp. in propelling vessels.
739. J. Evans, King's Langley, Hertfordshire—Imp. in the manufacture of paper.
741. J. V. Hielakker, Brussels—Improved apparatus for pressing or moulding artificial or patent fuel, fire-bricks, and similar articles.
742. G. Neal, Great Charles-street, Birmingham—Certain imp. in apparatus or fittings connected with the burning of gas for regulating and economising its consumption.
743. W. Delany, Norfolk-street, Strand—Imp. in ploughs for tilling land. (A com.)
744. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for the manufacture of sheet tin. (A com.)
745. P. P. Boll and H. Reger, Cologne—Imp. in steam boiler and other furnaces. (A com.)
746. F. Tillett, Banner-street, St. Luke's, Middlesex—Imp. in machinery for cutting splints for matches.

Dated 24th March, 1859.

747. W. Garforth and J. Garforth, Dukinfield, Chester—A certain imp. in metallic pistons.
748. W. E. Wiley, 34, Great Hampton-street, Birmingham—Imp. in the manufacture of boxes or cases used for holding needles, pens, matches, pencils, and for other like purposes.
749. W. E. Wiley, 34, Great Hampton-street, Birmingham—New and improved instruments to be used in burning and supporting candles.
750. F. E. Sharp, 3, Gloucester-terrace, Blackheath—Imp. in machinery for corking bottles.
751. E. S. Tebbutt—Imp. in the manufacture of elastic fabrics.
752. C. Sanderson, Sheffield—Imp. in preparing, tempering, and covering or coating thin strips or sheets of steel.
753. W. Clark, 53, Chancery-lane—A machine for separating oats from their husks or chaff. (A com.)

Dated 25th March, 1859.

754. H. Rigby, Salford—Imp. in machinery or apparatus for obtaining motive power, applicable to hoists, and all other purposes to which motive power can be applied.
755. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in telegraphic cables. (A com.)
756. R. Baker, Liverpool—Imp. in chronometers, watches, and other time-keepers."
757. J. H. Johnson, 47, Lincoln's in-fields.—Imp. in fire-arms. (A com.)
758. W. E. Newton, 66, Chancery-lane—Imp. in ovens for baking bread, and other substances. (A com.)
759. C. Hill, Chippenham station, Great Western Railway—Imp. in the permanent way of railways.
760. H. Humphreys, senr., Buckingham—An imp. in unhairing hides and skins, and in the manufacture of leather.

Dated 26th March, 1859.

761. G. Hasletine, 37, King-street—Imp. in the manufacture of small metallic chains. (A com.)
763. E. Steane, Manor-rise, Brixton—An improved means or apparatus for preventing candles dropping or guttering.
765. M. Firth, Sheffield—Imp. in machinery for grinding saws and flat plates of steel. (A com.)
766. Lieut. G. Naylor, R.M., 7, Durnford-street, East Stonehouse—An apparatus for measuring and indicating the distance passed over or travelled by the same.
767. J. C. Evans and P. Soames, Morden Iron Works, East Greenwich—Imp. in apparatus for superheating steam.
768. M. A. Muir, Glasgow, and J. McIlwham—Imp. in moulding or shaping metals.
769. E. Dowling, Little Queen-street, Holborn—Imp. in weights.
770. B. Smith and C. L. Smith, Corbet's-court, Spitalfields—Imp. in the preparation of certain colouring matter, applicable for dyeing and printing.
771. J. Buckley, Horwick, Lancashire, O. Greenhalgh, and R. Hutchinson—Imp. in machinery or apparatus for printing woven fabrics.

Dated 28th March, 1859.

772. C. J. Richardson, 34, Kensington-square—Imp. in apparatus to be applied to chimnies or flues of buildings, for preventing downdraught or return smoke, for their insuring upward ventilation, and for reducing the quantity of smoke or the blacks from the smoke passing into the atmosphere.
773. C. F. Vasserot, 45, Essex-street, Strand—An improved diving apparatus. (A com.)
774. J. Buckingham, Westmoreland-house, Walworth Common, Surrey—Imp. in machinery or apparatus employed in drawing fibrous substances.
775. A. V. Newton, 66, Chancery-lane—An improved construction of furnace for reheating steel preparatory to the hardening, tempering, or annealing process. (A com.)
776. A. Turner, Leicester—Imp. in the manufacture of elastic fabrics.
777. A. V. Newton, 66, Chancery-lane—Improved apparatus for retaining the oil or other flued used for annealing, tempering, and hardening steel at an equable low temperature.

Invention with Complete Specification Filed.

814. F. P. A. Auburtin, 32, Gerard-street, Islington—An improved preparation of food for herbivorous animals.—1st April, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, April* 8, 1859.]

April 8th.

2236. E. V. Rippingille.
2238. J. Mitchell, H. Mitchell, and T. England.
2240. A. Nicholls and T. Walker.
2247. F. W. Gerhard.
2256. J. Holroyd.
2257. C. F. Vasserot.
2259. J. Beattie.
2260. R. Cowen.
2261. J. L. Hancock and F. L. Hancock.
2266. T. Riddell.
2270. L. Wray.
87. L. Cowell.
89. A. Gordon.
2294. H. Martin.
2312. J. P. Gillard.
2335. W. E. Newton.
2369. R. Bodmer.
2377. F. Fowke.
2404. C. Pooley.
2533. A. V. Newton.
2717. J. H. Johnson.
2978. H. Hutchinson.
2980. A. V. Newton.
230. H. Brecknell and J. Dyer.
355. J. Aspinall.
406. W. E. Newton.
422. J. T. Jones.

[*From Gazette, April* 12, 1859.]

April 12th.

2274. G. Beadon.
2275. J. A. Gasse.
2283. A. Benda.
2285. J. C. Ollerenshaw.
2288. C. Cowper.
2293. S. Perkes.
2295. G. Baxter.
2297. S. Diggle.
2300. R. R. Jackson.
2302. G. Davies.
2309. F. J. Coulon and S. G. Giraud.
2316. A. Dunn.
2378. J. Robb.
2385. A. V. Newton.
2750. F. Fincham.
95. J. Gibbons.
280. J. Grimond.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, April* 8, 1859.]

April 4th.

814. R. Halliwell.
830. A. Morton.
842. A. Morton.
852. W. J. Curtis.
860. G. F. Morrell.

April 5th.

874. J. Nash.

April 6th.

843. W. Terry.

[*From Gazette, April* 12, 1859.]

April 7th.

884. R. Richardson.

April 8th.

888. J. Barrans.
948. J. Nasmyth.
973. W. P. Savage.

April 9th.

892. L. Kaberry and A. Horsefield.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4157	March 10.	A Bottle or Roasting Jack	Gray and Bailey	Berkley-street, Birmingham.
4158	,, 16.	Automaton Mouse and Rat Trap	Colin Pullinger	Selsey, near Colchester.
4159	,, 26.	Shade for Candlesticks	Brecknell, Turner, and Sons	The Bee Hive, Haymarket, S.W.
4160	April 4.	Overcoat, to be called the Vienna Wrapper	Moore, Adams, and Peade	2, Friday-street, Cheapside, E.C.
4161	,, 5.	Self-sustaining Ear-Ring	Parkes and Fell	10, Upper Hockley-st., Birmingham.
4162	,, 12.	An Improved Drill	Taylor and Elvey	Edingley Southwell, Notts.
4163	,, 12.	A Pin or Skewer	Henry Parrich	Birmingham.
4164	,, 13.	A Machine for Charging Breech-loading Cartridges	George Jeffries	Golden Ball street, Norwich.

Journal of the Society of Arts.

FRIDAY, APRIL 22, 1859.

NOTICE TO LOCAL BOARDS.

Forms No. 1 and No. 2 (see Appendix to the Examination Programme) have been issued to the Secretary of each Local Board, and careful attention to them is particularly requested.

ELEVENTH ANNUAL EXHIBITION OF INVENTIONS.

The Exhibition will be opened on Monday next, the 25th inst., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, having their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman. Cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

Members of Institutions who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

NATIONAL PORTRAIT GALLERY.

It is officially announced that the National Portrait Gallery will be open to the public, by tickets, on Easter Monday, Tuesday, and Wednesday, from ten to five o'clock.

Tickets may be obtained, on application, of Mr. Metchim, stationer, 20, Parliament-street, and of Mr. Dufour, stationer, 17a, Great George-street, Westminster.

The Trustees do not feel that tickets can be entirely dispensed with, on account of the smallness of the temporary apartments where the collection is located. Hereafter, when the Portrait Gallery becomes a popular and extensive institution, it will always be a pleasure to remember having seen it in the first state of development.

When the National Gallery of old masters was first opened to the public it was likewise in a private residence—Mr. Angerstein's house—in Pall-mall.

At present the National Portrait Gallery comprises about seventy pictures. The names of the persons and of the artists, with the dates of the pictures, are affixed to the frames, and biographical catalogues have also been prepared.

EXAMINATIONS, 1859.—LOCAL BOARDS.

The following Local Board has been appointed since the last announcement:—

For Skipton Mechanics' Institution.

Mr. Robert Blackburn.
Mr. Samuel Farey.
Mr. John Heap.
Mr. Thomas Rendall, *Secretary.*

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
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COLONIAL INSTITUTION.

A Society of Arts, Agriculture, and Commerce has been instituted in Belize. The objects which the promoters of the Honduras Association have in view are:—

First. The development and utilization of the numerous resources of this colony, the extension of its commerce, and the general increase of its importance and value as a possession of the British crown.

Secondly. To afford the means of intellectual improvement, and the acquirement of useful knowledge to all classes of the community, not alone to adults, but also to those pupils of the various schools whose progress in education, and whose taste, will enable and incline them to take advantage of those means,—to present to the public a mode of rational occupation in their hours of leisure, which, whilst it will instruct, will also entertain, and to substitute for the pleasures of sense, the higher and more lasting enjoyments of the mind.

The promoters of this Association propose to appropriate a suitable building to the purposes of the Society.

This building will include a reading room, a lecture room, and a museum.

The reading room will contain a collection of instructive and entertaining books; some of the London daily and weekly papers; several of the cheap English and American publications, and a few of the quarterly and monthly periodicals.

In the lecture room, lectures will be delivered on different branches of knowledge,—on history, philosophy, science, the mechanical, and the fine arts, and poetry,—but all discussions connected with theology and politics will be strictly prohibited.

In the museum will be deposited all the specimens which can be procured of the animal, vegetable, and mineral productions of Honduras, and to this repertory all persons taking an interest in the diffusion of knowledge, the progress of the mind, and the prosperity of the colony, will be invited to contribute,

It is also proposed to establish a botanical garden, in which, not only all the plants indigenous to Honduras will be cultivated, but also those peculiar to other countries, the growth of which a tropical climate will not prohibit.

The members of the Society will be elected by ballot. A subscription of ten dollars per annum, to be paid in advance, will be required. The President of the Society is His Excellency Frederick Seymour, H.M. Superintendent.

BRITISH HONDURAS.

By W. Wemyss Anderson.

As the enormous value which now attaches to good and favourably situated land in sugar-producing countries invests with increased interest and importance all communications on the subject, let me beg the use of your columns for a few observations. Having been in Belize on a visit of business for some weeks, I availed myself of an opportunity to ascend the Belize river, that I might see what was beyond the low-lying land which immediately surrounds this town, and which, I fear, has often impressed casual visitors as to the whole country. I was surprised and delighted. No description could have effected such a change in my original impressions. As we proceeded up the river, the land began very gently but sensibly to rise, and the mangroves to disappear. After sailing about seven miles, the country opened beautifully, and the land appeared covered with excellent pasture, on which cattle, sheep, and horses were feeding, and setlers' houses appeared here and there. I observed one handsome residence with outhouses, and a small sugar work attached, and abundance of orange and cocoa nut trees scattered over it. We visited an intelligent and industrious German and his family, who had settled on a large tract of land on the bank of the river He had enclosed a large garden, and was rapidly making money by supplying the Belize market with yams, sweet potatoes, vegetables, and fruits of all sorts. Though the land all around, as far as the eye could reach, was flat and covered with trees, yet it was not *parched*, and he could depend on the rains for preserving his cultivation in life, and bringing it to full maturity. He had four white men engaged as labourers, and on everyside he and they appeared to be surrounded with comfort and abundance. He had not devoted himself to sugar culture, for he had not capital to erect works or procure cattle, but he had a patch of canes, which, like the rest of his cultivation, appeared thriving, though it was neglected. All around could be easily ploughed. No manure would be requisite for many years; and, had sugar been the object of his industry, he could have rolled the casks into flat-bottomed boats, and in two hours have had them at the ship's side, in the roadstead off Belize. The far-famed advantages of the first sugar district in Cuba, Cienfuego, which I have seen, are exceeded by this district, inasmuch as, added to equal fertility and openness to the economical operation of ploughing instead of the hoe, it possesses the incalculable advantage of access by water, a deep, soft, flowing river, and easy economical shipment and sea carriage, at freights not exceeding what are charged on sugars from Jamacia. The healthiness of the district I found to be certified on all hands, and by every one who had resided in the country. So far as my own short experience and feeling may constitute an additional testimony, it has been confirmatory.

But this, I learn, is by no means the most favourable district. There are immense tracts to the northward, around the rapidly increasing town of Corasal, which are considered more rich and fertile in respect of soil, and equally as accessible in respect of water carriage. I greatly doubt whether England has any colony with equal agricultural advantages, especially for the production of sugar. Cotton also grows abundantly, and probably the most valuable kind, the "Sea Island," would thrive best of all. The rate of taxation is very low—the official establishments are on a moderate scale—there is no public debt—and the adminstration of law is prompt, cheap, and efficient. In all these respects its advantages are remarkable.

The progress of sugar cultivation has been slow, from want of local capital, and want of concentration of the scattered population in select districts, where capital and enterprise united, constitute a demand on laborious industry, in exchange for liberal compensation. That liberal wages to labourers, and liberal profits to agriculturists devoting themselves to sugar and cotton culture, would be realised, cannot be doubted. Already there are several hundred tons of sugar annually produced and made the subject of excise duty. From the statements I have received, it is apparent that abundance of land is available that will produce three tons per acre, and that when the cane is once established, it will last from ten to fifteen years at the least. If this do not satisfy the highest expectation of agricultural profit, especially when united to the easy water-carriage I have referred to, nothing else will. Governor Hinchs, of Barbadoes, in a lately published letter of his, to Mr. Tappen, of New York, stated that sugar estates in that island were worth £100 per acre. If so, what are the hundreds of thousands of acres of first-class sugar lands in this colony, on the banks of deep-flowing rivers, worth? I leave your readers to calculate.

Since commencing this article I have heard of the establishment, in London, of a limited liability company, with Mr. Samuel Gurney, M.P., as its trustee, for the cultivation of certain lands of British Honduras, with a mahogany-cutting business therein, which will secure dividends from the commencement, and afford the certainty of a large ultimate augmentation of the value of the company's stock.

Of its success beyond any other land-scheme that has been proposed, no one, I think, will be able to doubt, after they shall have been made aware of the true condition and internal relations of the country, its close proximity to England, and the salubrity of its climate. Its main disadvantage is the ease and abundance that a small amount of effort secures, which can only be met by the union in educational and civilising measures of the Government and the better classes, who have an interest in the soil.

CATALOGUE

OF THE

ELEVENTH ANNUAL EXHIBITION OF INVENTIONS.

BEING A COLLECTION OF ARTICLES RECENTLY INVENTED, PATENTED, OR REGISTERED, EXHIBITED AT THE SOCIETY OF ARTS, ADELPHI, DURING THE SPRING OF 1859.

N.B.—The Council wish it to be understood that they are not responsible for any of the statements contained in this Catalogue.

ENGINEERING, MINING, RAILWAY MECHANISM, &c.

(*For the remainder of the Articles in this Section, see Drawings.*)

1. Patent Coal Burning Locomotive Boiler; Peter Brotherhood, Railway Works, Chippenham.

This invention consists in the interposition, between the fire-box or furnace and the ordinary flues or tubes, of a combustion chamber, of a cylindrical or other form, connected to the fire box by one or more tubes surrounded by water. Between the fire box and combustion chamber, there is an air chamber, surrounded by water, having an opening for the admission of atmospheric air, and communicating with the combustion chamber through a number of small tubes, by which means the atmospheric air is brought into contact with the flame and gas entering the combustion chamber, and effects the combustion of the inflammable gases. In order to ensure a more perfect mixture of air with gas, a disc of fire-clay (or other suitable material) is placed at a short distance from the air tubes in the combustion chamber; on striking against this disc, the flame and inflammable gases are spread over the whole surface of the air tubes, thereby ensuring the perfect combustion of the gas, preventing the appearance of smoke, increasing the heat, and economising the fuel. The air tubes may also be introduced into the fire-box from the air chamber, so that when all the smoke is evolved and there is a clear fire, and the air is no longer required, the damper being shut, the air tubes are converted into effective heating surfaces.

2. Patent Improvements in the Adaptation of the Furnaces or Fire Boxes of Locomotive Engines for Burning Coal so as to Consume their own Smoke; Henry Ashton, Birkenhead.

This invention consists of an iron hood or deflecting plate fixed inside the fire box, and hinged over the doorway, inclined downwards and towards the middle of the fire box, in order to deflect the air entering by the doorway downwards amongst the gases or smoke; it can be regulated to any inclination according to the variation of the fuel in the fire box. The fire door is also hinged from the bottom, and provided with two side plates, to prevent the ingress of any air except from the top, and is retained in its position, by the rack or sector, to any degree of opening, to regulate the admission of the air. The aid of a jet of steam in the smoke box is required when the engine is standing and the blast off.

3. Patent Steam Boiler; Robert Armstrong, North Woolwich, S.E.

This boiler contains two generators, the smallest number that can be advantageously used in any case. This particular form of generator is called the "double taper shape." Instead of both ends of the generator forming equal frustums of similar cones, sometimes one end only may be conical while the other portion is nearly or quite parallel, forming what may be called the "single taper" or "trumpet shape." Such a trumpet-shaped tube or generator may sometimes be used within the upper part of a fire-box or in a furnace flue of small diameter, where the latter passes through the steam chamber, when used for the purpose of superheating and drying the steam where it may not be required to act as a stay. But in the middle of the fire-box itself the double taper-shaped generators are preferred to be exclusively used, for their greater strength and superior steam-generating qualities, and also because, when crossed at right angles, the greatest number can be got into a given height of boiler, or the same collective area of steam-generating surfaces can be brought nearer to the fire. The mode of fixing the steam generators to the fire-box by means of angle-iron rings, either riveted or otherwise, by which they are made to project into the water space and thereby enabled to carry the escaping steam from the ends of the generators away from the vertical sides of the fire-box, consequently preventing any injurious repulsion therefrom, is also equally applicable and advantageous to single taper-shaped as well as parallel tubes, when such tubes are placed horizontally in the fire-boxes or furnace chambers of boilers. (See *Engineer*, Feb. 18, 1859.)

4. Picking's Patent Boiler Feeder; Thos. P. Purssglove, 1, Sussex-terrace, Battersea-fields, S.W.

This apparatus is intended to be fixed near to, and a little above, the boiler to be supplied. It consists of a strong iron vessel, which is made to communicate with the upper and lower parts of the boiler by means of two pipes, one of which supplies the feeder with steam, while the other conveys the water from the feeder to the boiler. There is also another pipe, which leads from the water supply, and through which the water rushes into the feeder. Each of these pipes is furnished with a valve for opening and closing it; that in the boiler supply-pipe is self-acting, but those in the steam and cold water pipes are actuated by an arrangement of floats inside the vessel. When working, and the vessel has just been filled from the water source, the steam is turned on by means of the floats, and the water is allowed to fall by its own gravity into the boiler, and the moment it is empty these floats shut off the steam and open the cold-water valves; this causes the steam in the vessel to be condensed, when it is again filled with water.

5. Duncan and Gwynne's Patent Spiral Heat Diffusers; Gwynne and Co., Engineers, Essex-street Wharves, W.C.

These twisted plates of metal, when introduced into the tubes of steam boilers, produce a change or circulation of the heated products of combustion in their passage through the tubes, and arrest a large measure of heat, transmit it to the water, and convert into working steam that equivalent which, without these appliances, even in the very best boilers, would escape through the flues and be lost. Their application does not require any alteration in the boilers at present in use, and they can be fitted in a few hours. Marine and other boilers supplied with the heat diffusers will be less corroded internally than boilers in which a large portion of the heat passes away in the smoke.

6. Patent Woollen Felt for Covering Steam Boilers and Steam Engines; Jeremiah and Peter Garnett, Wharfside, Otley.

This felt is composed entirely of waste woollen refuse from paper mills, which is converted into a coarse pulp in the ordinary rag engine for paper-making. It is put upon the steam boiler in a wet or pulp state, and matted together by beating with a piece of flat wood; when dry it becomes one solid piece, and is an excellent non-conductor of heat, as upon a boiler working 50 or 60 tons pressure, it is stated that candles may be laid for weeks without melting. It may at any time be taken off and replaced by steeping in hot water until again softened.

7. Patent Improved Marine Engine; J. A. Limbert, Engineer, R.N., H.M. Ship Cæsar.

The object of the arrangement of this engine is to economise the space occupied by the engine. The drawing (See No. 380) illustrates the comparative space occupied by engines of similar power in H.M. ships Cæsar and Princess Royal, as compared with those on this principle, by which it appears that the economy amounts to nearly one-third.

8. Patent Economic Smoke-Consuming Boiler; Price and Dawes, Cleveland Works, Wolverhampton, and 24, St. Swithin's-lane, London, E.C.

This boiler is cylindrical in form, with a main longitudinal tube from end to end, having a number of oblique taper tubes placed within the lower half of the circumference of the shell or body of the boiler and the main longitudinal tube, into which they open and convey the hot air, &c., from the fires, the whole of it passing direct to the damper-flue and chimney, thus dispensing with horizontal return flues. (See drawing, No. 377.)

9. Patent Safety Apparatus; Price and Dawes.

This is made to act upon the ordinary safety valve, to let off the steam, and prevent explosions from deficiency of water, and also to indicate the height of the water, and whistle to call attention to high and low water.

10. Patent Governor for Marine and other Steam-Engines; Price and Dawes.

This consists of a ring of metal hinged upon a revolving shaft, and placed within the current of steam passing to the engine; being also so arranged that by its centrifugal power acting in opposition to a spring, the speed regulates the area of the opening and the allowance of steam to the engine. Instead of about 30 points of bearing, as in the ordinary governor and throttle-valve, this governor has but five, three of which only are called into action on opening or closing. (See drawing No. 385.)

11. Patent Adjustable Expansive Gear; Price and Dawes.

In this gear the closing of the steam is effected by either knuckle-joint or catcher actions, actuated by adjustable stops or cams, by hand, or by the ordinary governor, as the case may require. With this gear the engine can be handled with the same facility as those having no expansive movement. (See drawing No. 386.)

12. Patent Rolling Lever; Price and Dawes.

This lever has a travelling fulcrum for opening or lifting valves, and the rolling action of the lever gives great power at the commencement of the action, or when the full pressure is upon the valve. When used for steam engines with double gears neither equilibrium valves nor check-straps are required.

13. Patent Steam Pressure Gauge; (Taylor, Son, and Nelson); Dean, Travis, and Co., 8, Market-place, Manchester.

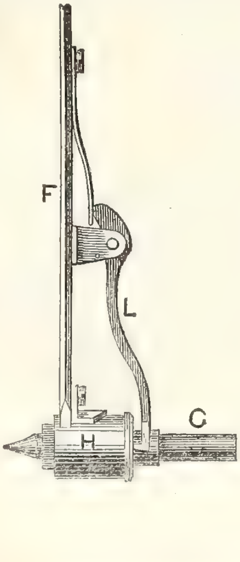
The principle of this gauge is "weight against pressure." Its action is as follows:—To the front of the boiler is screwed one end of a syphon, to the other end of which is attached the gauge; the syphon is filled with water, which is, by the pressure of the steam, forced against a vulcanised india-rubber diaphragm, upon which rests a spindle with cross-head acting as a lever to two weights, which, when the spindle is forced upwards by the pressure of steam, are gradually elevated on each side, thereby causing the hand to indicate upon the dial the amount of pressure in the boiler.

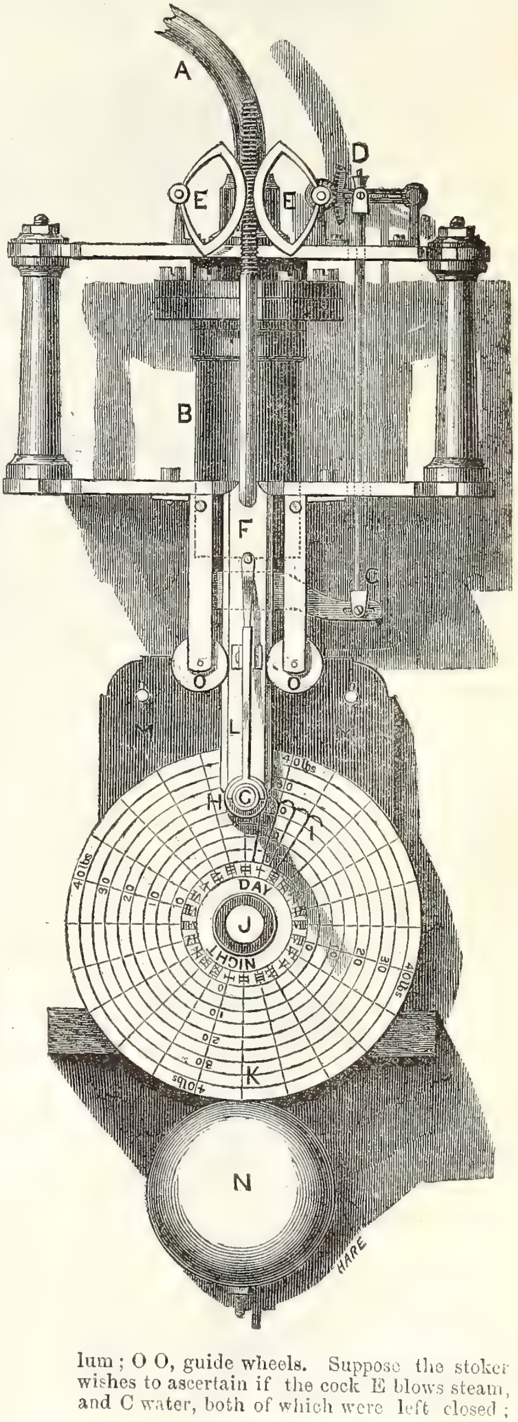
14. Patent Combined and Deposit Water Gauge; William Chesney, Willenhall.

This gauge is fixed on an upright filter, of a sufficient length to prevent any deposit that may be formed from choking the guage. The deposit may be run off from below. This gauge is therefore especially intended for boilers where muddy water is used.

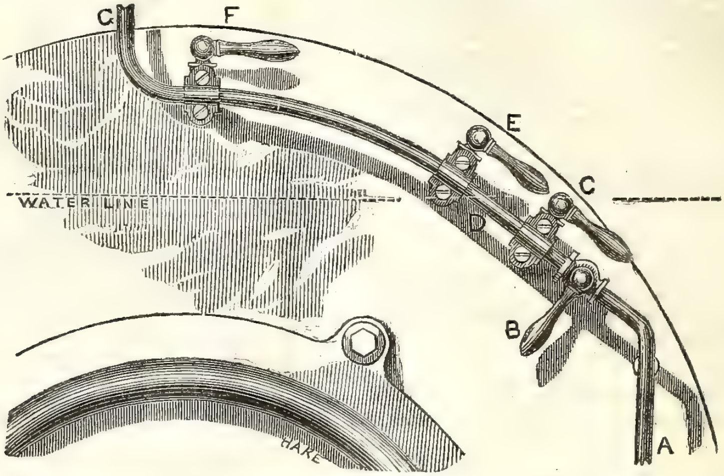
15. Patent Safety Apparatus for Steam Boilers; W. Mann, Dorset-street, Salisbury-square. E.C.

In this apparatus, the pipe A (See woodcuts) admits steam to a spring piston in the cylinder B, which descends in proportion to the pressure of the steam in the boiler; the arm C is fixed to the end of the piston-rod, and is carried downward with it; the segmental rack D, being connected to the arm C by a rod, also follows the downward motion; the rack D gears in a pinion, on whose arbor is fixed one of the quadrant heads E E, and which, from the nature of the arrangement, will have an upward motion; hence, as the pressure of the steam increases, the pencil in the pencil bar F, will be drawn up to one of the circular lines of pressure on the diagram paper or card K, by the rack working between the two quadrant heads E E, the left-hand one acting only as a guide. G is the pencil, which can be removed in a moment, if required, by simply throwing up the lever L, in which condition it will remain until the pencil is replaced. The eight-day clock, M M, carries round once in twenty-four hours a metal disc, to which is fixed, by the thumb-screw J, the paper or card disc K, having thereon circles corresponding to the steam pressure from zero to 40 lbs. (or higher if required), and radial lines equal to the twenty-four hours of the day. N, pendulum; O O, guide wheels. Suppose the stoker wishes to ascertain if the cock E blows steam, and C water, both of which were left closed;





he first shuts the pressure cock F, which up to this time has been left open, and opens the abutment cock B; the pressure then contained in the pipe from the abutment to the spring piston will be immediately relieved by the steam rushing out at A; he then opens C, and finds water flow at A; on opening E steam is found to flow at A, as water did before, indicating that the water line lies between the two cocks, as shown in the figure. During this time, which need not be longer than usual, the spring will have returned the piston to its normal position, and the pencil have fallen to zero, leaving a mark that exactly corresponds to the time the cocks were opened; the man has then simply to shut B and open F, the pipe is again refilled with steam equal in pressure to that in the boiler, the piston descends a distance equal thereto, and the pencil returns to the circular line of pressure as before.



16. Patent High and Low Pressure Steam and Vacuum Gauges; Johnson & Varley, Peterborough.

Figs. 1 and 2 show cross section and front elevation of low pressure gauge. Figs. 3 and 4 show cross section and front elevation of high pressure gauge. These gauges have a peculiar construction and arrangement of spring pressure disc or plate, which communicates motion through levers, rods, or otherwise, to the pointer used for indicating the pressure or

FIG. 1.

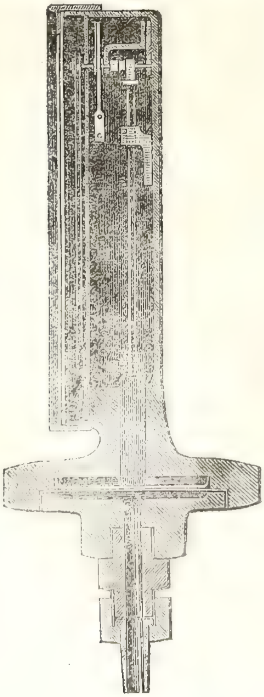
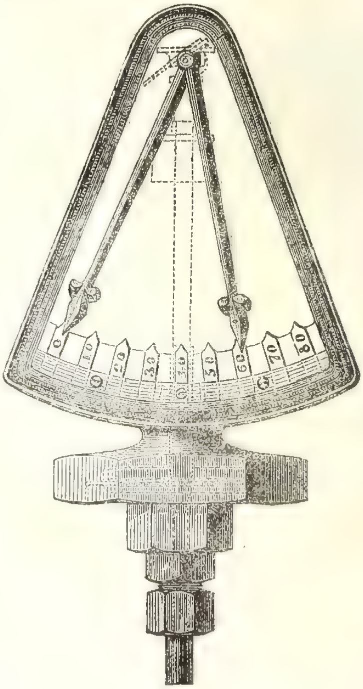


FIG. 2.



vacuum. They differ from other gauges in the peculiar form of disc employed, which, not being tied or fastened at the edge, is perfectly free in its action, thus avoiding liability to fracture. The pressure is transmitted from the back of the disc to the rim or flange from which it springs, the greatest amount of deflection being given out at the centre without injury to the plate, which, from its construction, can be made much stronger than those ordinarily employed. The arrangement of dial with moveable figures obviates the necessity of at any time renewing either the one or the other. This arrangement is applicable to existing gauges, and will enable a new spring to be applied without incurring the expense of a new dial. Both high and low pressure gauges may be made in the circular form, as in figs. 3 & 4. An additional pointer is used in the low pressure gauges, for showing the maximum attained.—(See *Mechanics' Magazine* for January 28, 1859.)

FIG. 3.

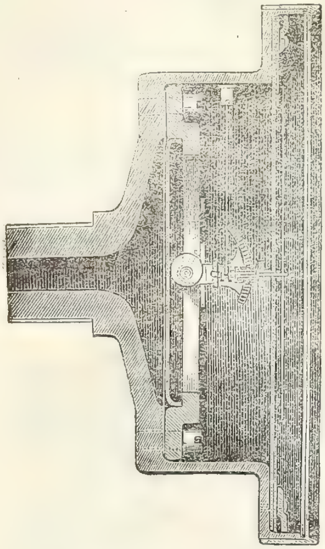
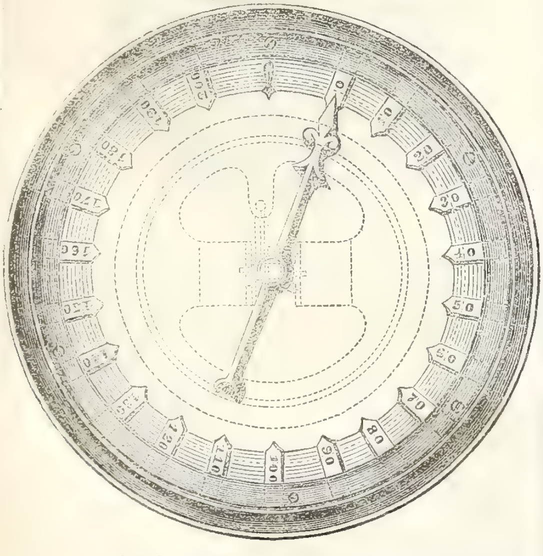


FIG. 4.



17. Evans' Electro Alarum Gauge; G. C. Trewby, Gas Works, Brentford, S.W.

This apparatus consists of an inner and outer cylinder, which communicate with each other at the bottom, the areas of the cylinders being equal, and representing two legs of a syphon. In the inner cylinder is a float, with a rod running through its centre. On the upper part of this rod are fixed two discs, one on the upper, and the other on the under side of the cover of the cylinder, which cover is insulated by means of a ring of wood. A wire connects one extremity of a galvanic battery to the cylinder, the other extremity of the battery being connected to one side of the alarum, the cover of the cylinder being connected with the opposite side. The gauge is about half filled with water; and, a communication being made between it and the inlet-pipe of the exhauster, the apparatus is in action. By this arrangement the float rises or falls, according to the pressure in the hydraulic main, and thus brings the points of platina in contact with one or other of the electrical communications, by which the bell of the alarum is thrown into action, and continues to ring until the pressure in the hydraulic main is altered.—(See *Journal of Gas Lighting*, Oct. 14th, 1856.)

18. Haste's Patent Valve for the prevention of Boiler Explosions; Bray, Waddington and Co., New Dock Works, Leeds.

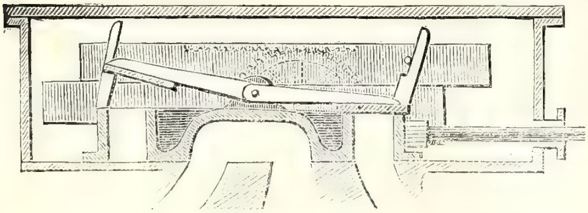
This invention consists of a double cylinder fixed upon the boiler in the ordinary manner. One of the cylinders contains a balance weight resting upon a valve seat, the area of which can be adjusted to any pressure of steam required. The other cylinder, which is connected by a steam-way, contains a piston acting upon an inverted double-seated cylindrical valve, open at both ends, so that the steam may pass freely through, forming two separate openings for the escape of steam from the boiler. The said valve is also attached to a float by a lever. Hence, should the water in the boiler be reduced, by evaporation or otherwise, to a point determined upon, the valve will be opened. Should the steam be raised a fraction of a pound above the determined pressure, the valve is immediately acted upon and opened by the rising of the balace weight. When fixed to the boiler, no person can interfere with its action.

19. Patent Improved Steam and Fire Regulator; Robert Griffiths, 69, Mornington-road, N.W.

This Fire and Steam Regulator is stated to to so readily adjusted that the variation in the pressure of steam need not exceed two pounds per square inch, or the variation may be ten pounds if desired.

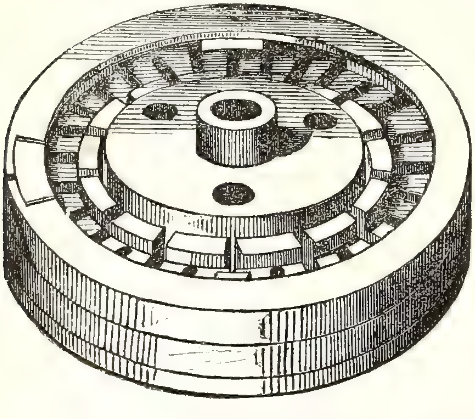
20. Patent Alterative Expansion Slide Valve; Joseph Hall, Derby.

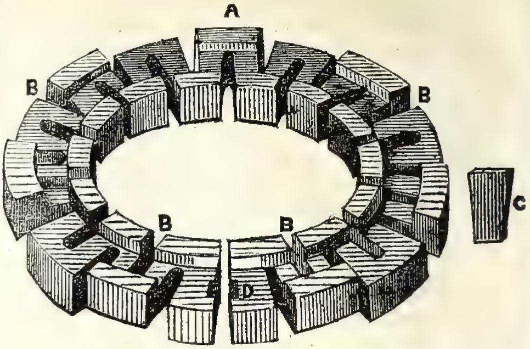
This slide valve is of the ordinary construction, with the addition of a steam port at each end, which ports are covered by flap valves lying on the top and mounted one at each end of a lever, which vibrates on a central fulcrum attached to the back of the valve, and is kept in position by means of a spring. These flap valves are each furnished with a friction roller, which is acted on by a fixed cam placed at each end of the throw of the slide valve. As the flap valves are raised, they are held by retaining levers (acted upon by a spring) until the return of the slide valve brings these levers alternately against one or other of two stop pieces attached to slides. The valve lever is thus released, and the cam at the other end brings the valve down and shuts off the steam. This can be done at any part of the stroke, as the slides which carry the stops are moveable, and so connected by a pinion and racks as to be capable of being moved nearer to or further from each other. A lever attached to this pinion is connected to the governor of the engine in such a way that as the speed of the engine varies, the stops are moved nearer to or further from each other, and thus the amount of steam allowed to enter the cylinder is regulated.



21. Patent Vulcanized India Rubber Valves; North British Rubber Company, Castle Mills, Edinburgh.

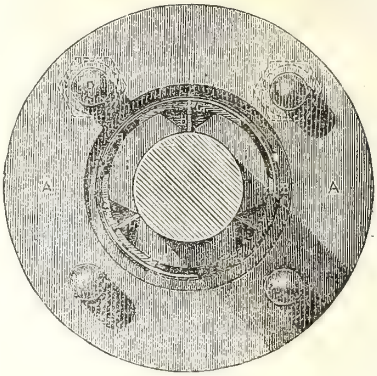
22. Patent Metallic Spring Pistons and Plungers; W. Parkin and Co., Bridge Foundry, Attercliff, near Sheffield.



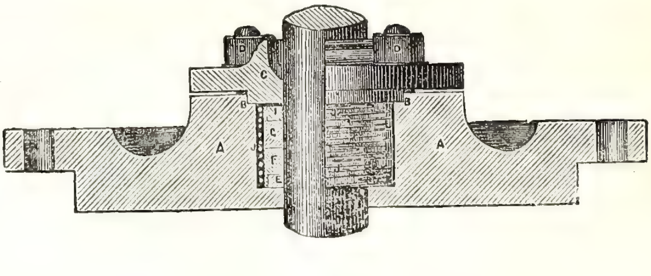


They are so constructed and arranged that they are rendered perfectly steam, air, or watertight, by means of metallic packing; and will resist a pressure of 500lbs. to the square inch. One part of the invention consists of an elastic pressure ring A, which is made elastic by indents, or slots, B, in opposite directions, and more than opposite depth, which makes the ring spring in circumference, when a wedge, or key, C, is forced into the ordinary cut, or opening, D, which wedge, or key, expands or enlarges the ring to the necessary degree of strength required. The wedge or key may be replaced by a larger one, when the packing rings require more expansion on account of wear and tear. Another part of the invention is to make the elastic ring to yield up and down, giving the piston, or plunger, increased facility to work with great steadiness and freedom.

23. Patent Metallic Gland Packing; R. Anderson, Blackbraes, Falkirk, N.B.



This packing, as supplied to a piston-rod stuffing box, consists of a set of brass segments, made to fit the rod accurately by being embraced by external plate springs. The two inner packing rings are in the centre of the series, being



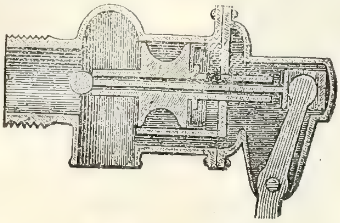
each preferably formed in four distinct parts, the ends of the segments being so shaped as that each shall have the same bearing on the piston-rod after being worn as at first. This metallic packing is equally applicable to the packing of pistons, and may be used in other cases where fluid tightness is required.

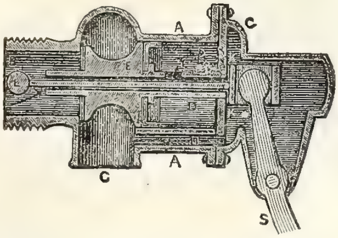
24. Improved Taps and Valves; John Warner and Sons, 8, Crescent, Cripplegate, E.C.

25. Hinks's Patent Self-cleansing Filter Tap; Samuel Sheppard, Birmingham.

This tap has two water-ways, one communicating directly with the cistern, and the other having a filtering medium in it, so as to filter the water as it is drawn off.

26. Patent Hydrostatic Ball Valve; George Jennings, Holland-street, Blackfriars, S.





The valve of this cock is closed, not by the action of the ball, as is usual, but by the hydrostatic force of the water, which accumulates in the chamber when the ball rises, the area of the chamber being superior to the valve face.

27. Patent Feed-cistern for Boilers; George Jennings.

In this model the cock and ball are fixed in a glass vessel to illustrate the action.

28. Patent Water-waste Preventor, applicable for Domestic and Sanitary Purposes; George Jennings.

This apparatus is intended to obviate the necessity for cisterns, high-pressure cocks, valves, and other appliances which have been invented to meet the requirements of a constant supply at high pressure. It may also be used for public fountains and for domestic purposes. The model shows the diaphragm, and the mode of supplying and discharging the contents.

29. Patent Gun Metal solid bottom Stop and Bib-cocks, with Stuffing-box tops, &c., for Steam, Gas, or Water; George Jennings.

30. Patent fullway India rubber tube stop-cocks with Union Joints; George Jennings.

31. Patent Iron Taps; W. Jas. Payne, 119, Waterloo-road, S.

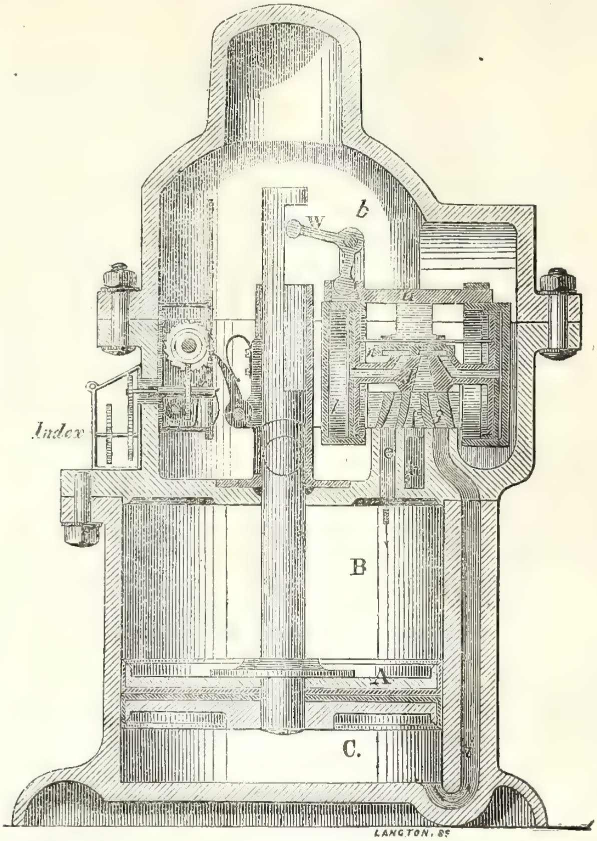
In these taps all tendency to rust in the working parts is obviated by the conical part of the plugs being coated with pure gun-metal, and the barrels lined one-eighth thick with an anti-frictional alloy of tin, poured in the molten state around a steel core, placed in the centre of the barrel, thus leaving a perfectly smooth interior ready to receive the plug; the water-way being kept continuous through the barrel during the pouring in of the alloy, by a steel bar passing through a slit in the steel core. They are intended to withstand the bursting effect of frost, as, besides being made much stronger than would be practicable in brass, by the simple arrangement of making the discharge side of the way through the plug wider than the inlet, no water is left within when turned off (one of the chief causes of taps bursting). The washer also at the bottom of the plug differs from ordinary ones in having a circular groove in its under side filled with vulcanized India-rubber, against the elastic surface of which the tightening nut underneath acts, thus giving a constant and self-regulating pressure to the plug in the barrel conformable to the changes of temperature.

32. Patent Couplings or Pipe Unions; W. Heap, Oldham-road Tool Works, Ashton-under-Lyne.

These are intended for instantaneously joining lead or iron pipes, without the use of solder. This is effected by means of a double screw.

33. Chadwick and Frost's Patent High-Pressure Piston Water Meters; Bryan Donkin and Co., Bermondsey, S.E., and Herbert Frost and Co., Manchester.

The advantages of this meter are stated to be: 1st. It is of less bulk and weight. 2nd. It never requires lubricating, as all the parts work in water. 3rd. It is not liable to be tampered with, and the valve cannot be fixed so as to let the water escape without being registered. In the annexed section, the meter is shown working. The water is entering the upper chamber of the meter *b*, and is passing down *e*, into the measuring cylinder B; the pressure of the water being exerted in forcing the piston A to the bottom of the cylinder; the water is being expelled out of the lower part of the cylinder C, up *i* and *g*, down *f*, and out at *h*. On the completion of the stroke of the piston, the projecting end of the piston rod carries with it the catch W, which moves the top slide valve *u*, and allows the water to escape from the small cylinder or cup *l*, and admits it into the opposite cylinder or cup, whereby the fluid pressure is exerted directly against the end of the main valve *j*, and changes its position, and thus reverses the action of the meter instantaneously, and without any noise or concussion. Each stroke of the piston is communicated to the index, and the exact quantity of water discharged is duly registered.



34. Patent Bored and Polished Glass Cylinder Pump; J. Chedgey, The Grove, Southwark, S.E.

35. Patent Safety Cage for Miners; Barnes and Loach, 348, Summer-lane, Birmingham.

The principle of this invention is that the weight of the cage acts upon levers which come in contact with the sides of the shaft, and support the cage in case the rope breaks.

36. Patent Safety Lamp; Alfred Sterry. Swansea.

In this lamp the globular form of the wire ensures coolness and steady supply of air to the flames, and direct egress for the light in all directions equally. The turned wire prevents rust, which ordinarily so much diminishes the apertures. The double-cap (the only part which is destructible in use) can be renewed at pleasure, being held in place by a screw. The oil supply being at the side, and the flame on the top of a steep cone, very little light is lost below by the shadow of the lamp. The lamp can be locked in the ordinary way. The burner is supplied on the fountain principle, which ensures a constant supply of oil to the lint of the flame; hence charred wick and smoke are much diminished. With colza-oil, the lamp should burn six hours without snuffing. The oil supply is equal to 18 hours.

37. Patent Safety Lamp; Wilkins and Co., 24 and 25, Long Acre, W.C.

In this lamp the flame is surrounded completely with glass or talc. The gauze, which in the Davy lamp is continued from the level of the wick upwards, obscuring the light, commences here some 3 inches higher. The draught is maintained by the external air passing through the body of the oil-can by means of four large tubes around the wick, communicating with a lower chamber in connection with the external air through the meshes of a fine metal gauze. Two kinds of these lamps are now being manufactured—one intended to be used in situations where the existence of explosive gases may be remedied as soon as discovered, as in sewers, gas-works, &c.; and the other in mines and situations where workmen are obliged to work continually in an atmosphere highly charged with explosive gas.—See *Mining Journal*, December 11, 1858.

38. Patent Wheels and Gearing for Carriages propelled by Steam; James Braby and Son, Newington, Southwark, S.E.

This invention consists of an annular railway or drum, having on its inner circumference a conical rail. The driving-wheel works within the inner circumference, having a corresponding groove to the rail in the large wheel. Gearing is introduced to give different velocities in travelling, and a crank communicates with the connecting-rod of the engine. This model shows the application of the above principle to railway locomotives for ascending steep gradients.

39. This model shows the above invention applied to Carriages propelled by Horse Power; James Braby and Son.

40. Proust's Patent Hydro Syphoid Axle Box, lubricated by a combination of grease, oil, and water; John Braithwaite, M. Inst. C.E., 18, Great George-street, Westminster, S.W.

The construction of the axle box is, in all particulars, the same as the ordinary axle box, with the exception that it is surrounded on three sides by a cistern of water, which is charged through a valve, and hermetically closed, the only communication with the grease box being by means of a syphon, the longer leg extending through the bottom of the cistern or reservoir, which, being hermetically closed, prevents the operation of the syphon by atmospheric pressure in the usual way, which acts only in the event of any heating of the axle occurring, so as to cause the expansion of the water and air within the reservoir, forcing a few drops of water through the syphon, which, mixing with the molten grease, forms a saponaceous lather, acting immediately on the exposed portion of the axle, cooling it, and lubricating the bearing effectually, cooling the axle box, and thereby reducing the temperature of the water in the reservoir, so that the supply through the syphon ceases. The axle box is supplied in the usual way with grease or oil when it requires it; and the supply of water is through the valve, which must be opened occasionally, and the reservoir filled up. The economy of grease upon this system is stated to be 75 per cent.; the traction being diminished in direct proportion to the reduction of friction. The axle box exhibited has been running 18 months, and is in the same condition as when taken off the waggon on the Paris, Orleans, Tours, and Bordeaux Railway, being stated to have performed 34,788 miles without any additional supply to that which was supplied in the first instance, the remains being that which is now exhibited on the axle box. The axle box and brasses were second-hand when started, and have not been repaired since.

41. Patent System of Axle Boxes, not requiring Lubricating; Alphonse de Brussaut, 14, Surrey-street, Strand, W.C.

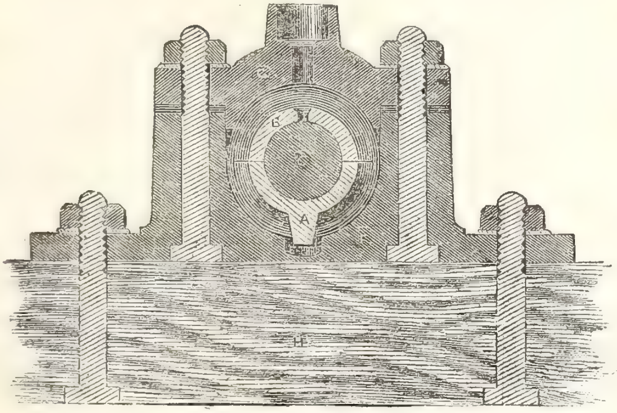
This apparatus consists of a series of four, six, eight, or any other convenient number of cylindrical rollers, of the length of the journal, retained at certain distances apart from each other, yet still united by elastic bands of vulcanised india-rubber. These rollers, thus united, and placed around the journal, are set in motion by the pressure of the axle, without the possibility of collision with, or friction against each other, or of rubbing upon the surface of the journal, or of the bearing, thus avoiding as much as possible any friction, or opposition to the motion of the journal. The action of rolling being thus substituted for sliding, there cannot be any abrasion of the substances, and lubrication is stated to be unnecessary.

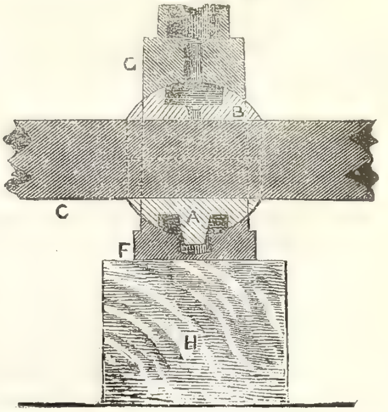
42. Patent Cast-iron Naves for Axles; James Braby and Son, Newington, Southwark, S.E.

The peculiarity of these naves and axles consists in the arrangement of the caps and reservoirs for holding the oil.

43. Patent Self-adjusting Spherical Bearings; Wallis and Haslam, North Hants Iron Foundry, Basingstoke.

This bearing forms a ball-and-socket joint, which adjusts itself to the direction of the spindle, passing through it, thereby doing away with the liability to heat or wear crosswise. The seat or block and cap are turned internally, so that when put together their interior surfaces form a spherical cavity, in which the brasses, which are turned externally to the





form of a sphere of the same diameter as the cavity, work freely in any direction. They are prevented from rotating with the spindle by a nipple on the lower brass, which fits loosely into a socket in the bottom of the block, but which allows sufficient motion for the bearing to adjust itself to any variation in the position of the shaft. They can be applied to railway carriage axles, as they will allow the wheel to rise or fall with the inequalities of the rail without at all affecting the bearing. The bearing has a channel cast round the exterior of the brasses, in order to lighten them, but this does not affect the working of the ball-and-socket joint.

44. Patent Railway Coupling, with Spring Catch; Walter Hall, 10, Pier-road, Erith, S.E.

The object of this arrangement is to prevent the coupling from unscrewing when in use; it is intended to be used with Hall's Patent Brake Apparatus. (See No. 50.)

45. Patent Universal Joint Couplings, as used with Patent Railway Brake Apparatus; Walter Hall.

This coupling has two centre pins, which pass through the hollow centre piece, so that when either of them is removed, the joint becomes detached. This hollow centre piece is a coupling to the apparatus, whenever the same is fixed to any part of the train, provided the universal joints are all of the same principle in the construction. (See No. 50.)

46. Patent Shackle; John Oxley, 7, St. Augustine's-road, Camden-square, N.W.

By this invention the body of a carriage is, as it were, insulated from the under-carriage, in which latter part the jar and rattle is generated. A cylinder of vulcanized India-rubber, or other suitable material, is inserted between the two parts of a shackle suitably constructed to receive it.

47. Patent Buffer and Draw Spring; William Wright & Co., Sheffield.

This is composed of a series of curved plates, with their faces arranged alternately in opposite directions, moveable on a metallic rod passing through their centre. The springs are acted on by an arrangement of draw levers. The principal advantages of this spring are stated to be its great strength and lightness. (See Drawing, No. 389.)

48. Patent Vulcanized India-rubber Buffers; North British-rubber Company, Castle Mills, Edinburgh.

49. Patent Improved Railway Brakes; W. P. Wilkins, Ipswich.

The strain of brakeing a six-wheel carriage is distributed equally upon six screws, not on one screw, as usual. It has no tendency to displace the axle or its bearings, it not being possible to press the block tighter on one side of a wheel than the other side. The two blocks and screws of a pair of wheels are straining points for each other, neither pressing the wheel until the other approaches and presses equally. By one handle it can be applied to all the wheels upon a carriage, or several carriages in the same train.

50. Patent Apparatus for Working Railway Brakes; Walter Hall, 10, Pier-road, Erith, S.E.

This apparatus consists of a square bar, suspended under each carriage, the connection being made by a universal joint coupling, so as to render the brake continuous throughout the train, thus making it possible to apply three or four brakes simultaneously. In making up a train, the brake-blocks of the brake-vans are screwed up close to the rims of the wheels, and then the coupling is effected so as to avoid the possibility of slack. The brake-blocks are so arranged on the carriages that two operate in each direction, so that the carriages may be moved either backwards or forwards, indiscriminately; but this is not the case with those attached to the tenders and the brake-van. There is a worm-wheel on the spindle of the handle from the van, working into a cog-wheel, loose on the longitudinal shaft. On this shaft there is a screw working in a loose collar, to which are attached the ends of one pair of levers, working the arm of a lever, on a fixed shaft, also carrying the levers to which the blocks are attached.—(See Minutes of the Institution of Civil Engineers, 23rd Nov., 1858; *Mechanics' Magazine*, 24th April, 1858; The *Engineer*, 10th Dec., 1858.)

51. Patent Permanent Way; Christopher Hill, Chippenham.

The rail is supported on longitudinal iron sleepers, which break joint alternately, and are bolted through the rail. They are made of either plain or corrugated plates.—(See drawing, No. 393.)

52. Patent Permanent Way; Christopher Hill.

In this arrangement the longitudinal sleepers, which break joint, are tubular, and enclose the lower portion of the rail. They are formed of two quadrants, with flanges bolted on to a semi-circular plate, also with flanges; the upper flanges of the quadrants being bolted through the rail.—(See drawing, No. 393.)

53. Patent Improved Railway Chair for joint and middle bearings; Hostage and Tatlock, Chester.

This chair is cast in two parts. One part consists of a base plate, with a cheek fitting one side of the rail, and elevated about an inch above the level of the base plate. The other part consists of a cheek, (also fitting the rail) with a tongue attached, which passes through the other cheek, and is secured by a collar and pins passing through both parts of the chair, and into the sleeper. The chair is principally intended for joints, but is equally applicable for middle bearings. It obviates the necessity of using a wooden key. It is also stated to possess the advantage of forming a perfect joint of the rails, without drilling or otherwise decreasing their strength.

54. Ashcroft's Patent Cushion Chair; Permanent Way Company, Great George-street, Westminster, S.W.

The jaws of this chair are slightly inclined, and have grooves running down them, so as to key on to wooden blocks or cushions which hold the rail in its position.

55. Improved Railway Chair; Jas. T. Relph, Bexley Heath, S.E.

In this chair the key is wedge-shaped, and is secured in position by a small iron pin passing through it at the side of the chair.

56. Plate and Channel Iron Permanent Way; J. W. Cruickshank, Cook-street, Chippenham.

This invention consists of a plate iron bed, 11 inches wide by ½ inch thick, parted at the joint on curves, and upon these plates are fang-bolted the bearers, economically cut out of channel iron, with one saw-cut only to each bearer. On these bearers the rails are fang-bolted, making the permanent way complete. The plate girder transoms are made with ¼in. plate iron, bolted to bearers which are opposite to each other. The accompanying model shows part of a girder bearer and rail-joint. (See drawing, No. 394.)

57. Patent Cup-trough Sleepers; James Samuel, 26, Great George-street, S.W.

These sleepers are of the form of an inverted cup, and have openings in their sides to facilitate packing. The rails are laid in a hollow at the top, on wooden bearings. (See drawing, No. 392.)

58. Patent Combined Iron and Timber Tramway Rail; J. C. Brant, 18, Surrey-square, Old Kent-road, S.E.

This rail may be used with the argillaceous sleeper, forming a continuous rail, the timber breaking all joints. Less iron is thus required.

59. Patent Consolidated Argillaceous Railway sleeper, with or without the ordinary Chair; J. C. Brant.

This sleeeper is not liable to decay, and is stated to be capable of sustaining any amount of heavy traffic. The surface bearing being large, constant packing is dispensed with. There is a cork cushion let into the sleeper, for the chair and rail, giving considerable elasticity.

60. Whitworth and Gibson's Patent Improved Compensator and Releasing Railway Signal; B. Vickers, Atlas Works, Sheffield.

61. Rigid Suspension Bridge for railway or ordinary traffic; R. M. Ordish, 18, Great George-street, Westminster, S.W.

This method of constructing bridges of large spans, includes ordinary curved suspension chains or wire cables, in combination with straight inclined chains, for supporting the platform and moving loads, the curved chains being employed solely to sustain the dead weight of the inclined chains by means of vertical rods, thereby retaining them in straight lines; and the inclined chains to support the whole weight of the platform and loads, which are suspended from the intersections of these chains which are not subject to alteration of form or disturbance of equilibrium by unequally distributed or moving loads, all tensile or compressile strains in the platform being avoided.

62. Kenney's Patent Balance Rolling Bridge; Turner and Gibson, Hammersmth Iron Works, Dublin.

This bridge is constructed with two longitudinal beams of iron or wood, with joists and flooring balanced and travelling on two rollers, and raised, opened, and shut by two others, requiring only one and a continuous motion from the time of starting until either opened or shut. It requires no intricate or expensive stonework.

63. Patent Fore Carriage; J. Oxley, 7, St. Augustine's-road, Camden-square, N.W.

This apparatus consists of a combination of a revolving motion with a transverse sliding motion, which causes the wheels to describe an ellipse in turning from the ordinary position due to a straight draught into any other position or angle, up to that of being at right angles with the hind or following wheels.

64. Patent Hinges for Carriage Doors; John Oxley.

This invention consists in forming a metal socket or cap for the bottom knuckle of the hinge, between the under side of which socket or cap and the top face of the bottom knuckle is inserted an elastic washer of vulcanized india rubber. As the upper end of the metal socket or cap is necessarily of larger diameter than the bottom knuckle, advantage is taken to increase the diameter of the face of the knuckle working above and upon it to the same size. By the introduction of the elastic washer, the injurious effects of vibration are prevented.

65. Patent Covering for Carriage Springs, composed of Caoutchouc or Gutta Percha; James Braby and Son, 32, Newington Causeway, S.E.

66. Patent Carriage Drag; James Braby and Son.

This invention consists of a jointed bar, with an arm at right angles, which grasps the tire of the wheel below the centre of the axletree, and effectually stops its revolution.

67. Patent Improved Truck or Solid Block Wheels for Gun and other carriages; James Braby and Son.

The object of this invention is to give perfect equality of bearing surface.

68. Patent Arrangement for fixing Carriage Windows; John Oxley, 7, St. Augustine's road, Camden-square, N.W.

This consists in the adaptation of a stud and slot, to fix the window when closed, and prevent rattle.

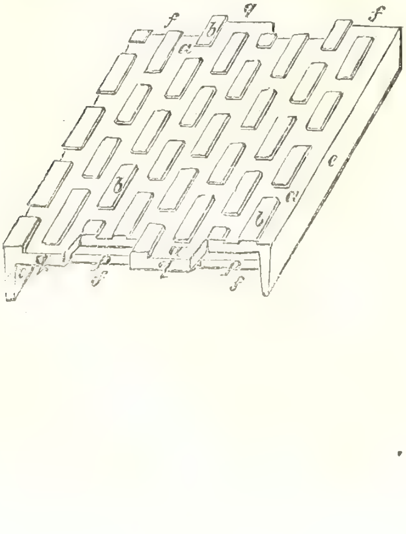
69. Patent Indestructible Wheel for Streets, common Roads, and for Agricultural Purposes; B. Samuelson, Banbury, and 76, Cannon-street West, E.C.

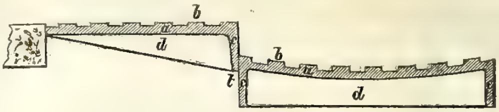
The chief peculiarity of this wheel is in the materials used. The nave is cast-iron; the spokes wrought-iron; and the rim or tyre is wrought-iron, with a facing of hard steel, both materials welded together in the process of rolling. The spokes form a series of loops of light hollow or gutter iron, placed back to back, the bend of the loops following the tyre in shape, whilst the two ends are cast into the nave. The hole in the nave is chilled to the same hardness as ordinary axle boxes. The wheels are made either straight or dished, and with flat or rounded tyres; the weight is little more than that of wooden wheels, and the cost is about the same, whilst the durability is much greater. They are specially adapted for hot countries.

70. Patent Caoutchouc Carriage Wheels; M. Davis, 5, Lyons-inn, Strand, W.C.

The periphery of the wheel is formed of a dish-like figure, in which the india-rubber lies, with a projection in the centre, dipping far down into the wheel, that as pressure increases so does security in proportion, and the rubber presents a curved figure to the road, similar to a new half-round iron tyre. The loose specimen tyre shows the form of india-rubber band employed, and is stated to have been used on the wheel of a Hansom cab.

71. Patent Channel Plates; Stephen Carey, Clink-street Wharf, Bankside, Southwark, S.

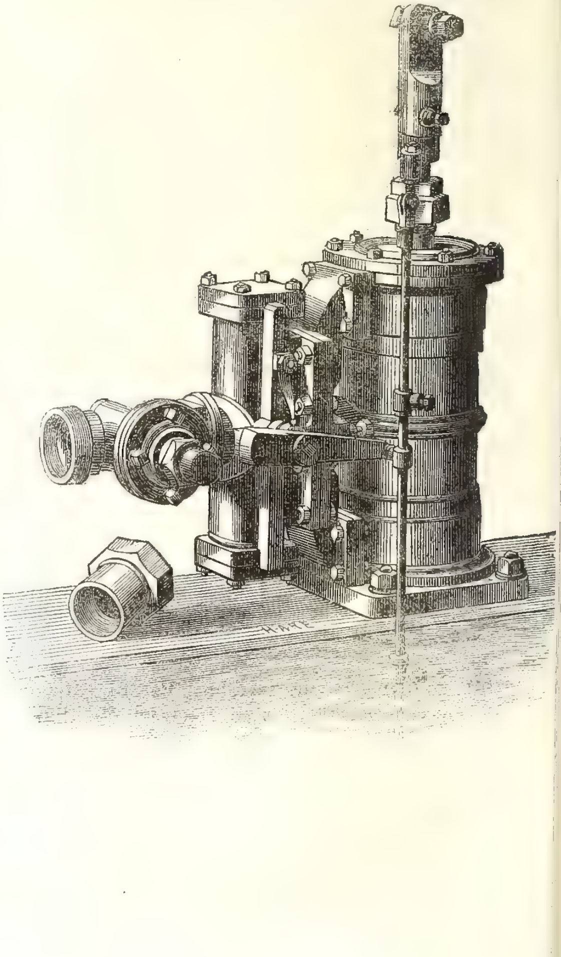




These plates may be cast of any width and length, the specimens are 16 in. × 16 in. superficial and 4 in. deep. The surface of the plate is concaved transversely $\frac{3}{4}$ of an inch, and has a series of broken fillets running longitudinally, which give a good foothold for the horse and allow the water to pass between, thus preventing the splashing.

72. Patent Hydraulic Engine for Organ blowing; David Joy, Queen-square, Leeds. Garrett, Marshall and Co., Leeds.

This engine is bolted by the flanges to an import of the organ, with its piston rod under or over the centre lines of the lever working the feeders; the water, at a pressure, is introduced at the cock, passes through the valves which are enclosed in the box, and gives a reciprocating motion to the piston rod, escaping at the pipe. (See *Journal of the Society of Arts*, Vol. VI., page 702.)



MACHINERY AND MANUFACTURING APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

73. Patent Apparatus for Producing at one operation Reverse Moulds for Casting Printing Surfaces; David Service, Barrhead, Renfrewshire.

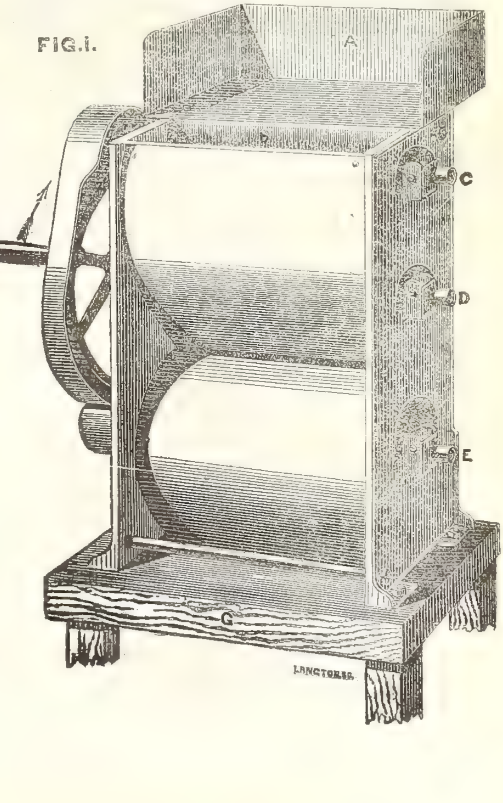
This machine produces two moulds at one operation, one on each side of the block of wood, the one being a complete reverse of the other. It consists of a perfectly level metal plate; an over-hanging bracket carrying a vertical reciprocating slide, to which is attached a tool-holder; a corresponding bracket underneath the plate, carrying a similar slide and tool-holder; and various arrangements for heating, by gas, the tools used in the operation of mould-making, and for moving and adjusting these tools, so as to burn into a block of wood, at one operation, a device or pattern and a reverse of the same, each surface being a perfect mould. The two slides being connected by a mechanical arrangement, they are simultaneously moved by means of a treadle, the descending tool entering the upper surface of the block of wood as the ascending tool enters, through an aperture in the plate, the under surface. The block of wood is moved by hand, according to the forms of the pattern or device, which is drawn only on the upper surface. The necessary adjustment of the tools is effected by lowering the upper one into contact with the lower by means of the rack and pinion movement on the adjustment slide; the lower tool-holder being made to turn round and fix in any position, while the upper one can be moved horizontally and transversely by means of the two small slides, and screws attached to the lower part of the adjustment slide which carries the top tool-holder. The tools can be made perfectly co-incident, and then raised to the required elevation.

74. Indian "Churka," or Cotton-Gin.* Exhibited by the Manchester Cotton Supply Association.

The committee of the Cotton Supply Association have received from the Bombay Chamber of Commerce two Indian churkas, or hand-rolling gins of native construction, and such as are now used by the natives of India, with a request that they should be submitted to the machinists of this country, with a view of obtaining, if possible, a superior machine. The objects to be aimed at in the making of an improved machine, are:—1. That the machine do no injury to the cotton, in the process of separating the seed from the fibre. It is said that no machine can possibly separate the cotton from the seeds with less injury to the staple than does the Churka. 2. That the machine, as far as possible, do rid the cotton from leaf and impurities. 3. That the machine be of simple construction, and durable. 4. That the machine be easily repaired by the native Indian. 5. That it be portable. 6. That the cost be as low as possible; (the Churka costs only two rupees, or 4s.); it is necessary that the improved machine should be within the ability of the natives to purchase. 7. That the machine be able to do its work faithfully, in spite of carelessness or neglect. 8. That the machine be able to clean a fair quantity of cotton per day, with the labour of one person (male or female). The committee submit the above conditions to the consideration of machine makers. It is proposed by the committee of the Cotton Supply Association, in furtherance of the wishes of the Bombay Chamber of Commerce, to hold a trial of the merits of the different gins, that may be constructed to meet the above conditions, in two or three months from the 25th March last. Due notice of the day of trial will be given. Premiums of £20, £10, and £5, will be paid by the Association to the exhibitors of gins which rank first, second, and third in order of merit.

75. Patent Toothed Roller Cotton Gin; Peter and Chas. Garnett, Cleckheaton, Yorks.

FIG. 1.



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* The Churka is exhibited in order that persons in London may have an opportunity of seeing its method of working.

With a gin of this kind, 3 ft. wide, it is stated that two persons can produce 200 lbs. of cleaned cotton per day. This machine is substantially made, and contains a metallic roller and a spiral saw or steel ribbon inserted into the spiral grooves of the roller. When driven by steam or water power at the rate of 200 revolutions per minute, it will clean 400 lbs. for each foot in length per day. It is well adapted for all classes of cotton, particularly fast seed cotton. There is no band or belt employed, hence the machine requires small power.

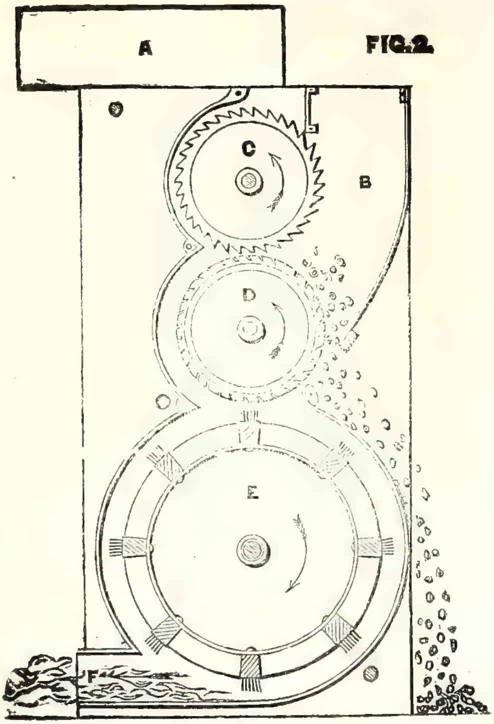


FIG.2.

76. Patent Cotton Saw Gin; William Jamieson, Ashton-Under-Lyne.

This is a four-saw hand gin, having a moveable metallic grid, or platform, for regulating the amount of projection in the saws to suit different qualities of cotton. The whole is fixed in a metal frame, and can easily be repaired.

77. Patent Boudoir Sewing Machine; Newton Wilson, and Co., 144, High Holborn, W.C., and 21, Old Bond-street, W.

This machine is designed to execute all ordinary domestic sewing, and adapted also for all light manufacturing purposes. It is mounted on a portable table, and motion is imparted by means of a treadle acting on a small friction-wheel, under the machine. This arrangement enables the machine to be protected from injury, as the box or cover in closing, detaches the machine from its treadle. The friction-wheel drives two small levers, one above and the other below the body of the machine. The upper one carries the piercing needle, and at the same time feeds the machine with its work, and carries it forward, regulating also, by a screw in the front, the length of stitch as may be desired. The under lever carries the looper or little instrument used in completing and securing the stitch on the under side of the fabric. There are two of these loopers connected with the machine. The one is simply a hook; and where the needle passes through the cloth, lays hold of the loop of tread, and retains it till the needle, passing again through the cloth, enters this loop and leaves another, drawing the first tight in its receding motion. The stitch thus made is that known as the tambour stitch. By changing the first looper, and substituting the second, a different stitch is formed. The hook of this looper has a longer point than the other, with an eye formed to carry a second thread; and the needle and the looper, by alternately intersecting the threads they respectively carry, form an interlocked or chain stitch on the under side. On the face of the fabric, the appearance of both stitches is alike, that of a back stitch. The thread is taken direct from the bobbin, and the stitch in each case is elastic, and therefore not liable to injury in washing or ironing. By adaptations which are attached at pleasure, the machine is made to turn down, fold, and hem, at the same time, also to lay and stitch binding on to the edges of a garment.

78. Patent Eyelet Machine; T. Gehrling, 15, William-street North, Caledonian-road, N.

In this machine the handle is so placed that the greatest power is obtained. Various sized punches can be readily adapted to it, and it can be easily adjusted for different thicknesses of texture.

79. Patent Hole-Punching Machine, for three sizes; T. Gehrling.

This machine is similar in construction to the eyelet machine, with the exception that by turning the head, in which three sizes of nipples are fastened, the required size of punch is brought into operation.

80. Patent Adjustable Binding Guide for Sewing Machines; Bradbury and Co., Oldham.

This apparatus consists of a series of upright steel pegs, over and under which the binding is alternately passed. It is then drawn in front of a shield, and passed through a guide having fixed tongues in it, which fold the binding so as to allow the needle to pass through it, and fix it to the fabric to which it is to be attached.

81. Patented Improvements in the Manufacture of Needles; H. Walker, 47, Gresham-street, E.C., and Alcester.

Fig. 1.

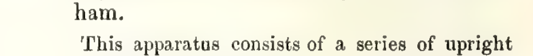


Fig 2.

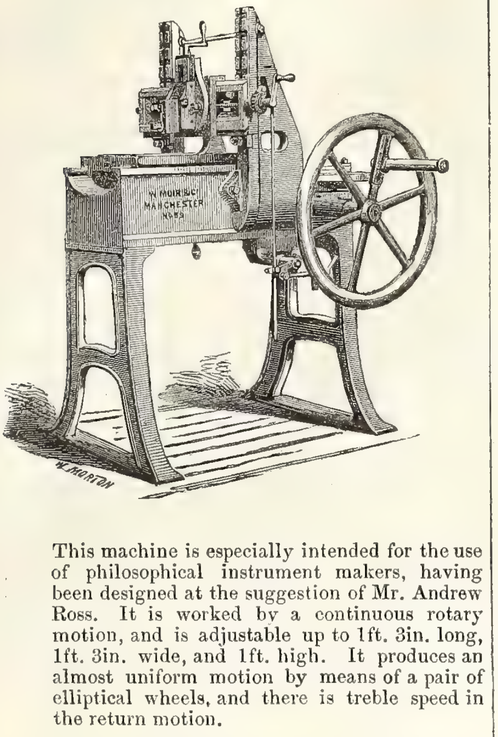
Fig. 1.—A is a ridge or raised part; B, the eye, which has a groove beyond it. Fig. 2 shows a side view of the parts, with the thread recessed as in sewing. This

needle is easily threaded, and the usual pressure of the thimble drives it with the thread through the cloth, without the least effort.—See *Engineer*, March 4, 1859.

82. Parmelee's Patent Machine Belting; North British Rubber Company, Castle Mills, Edinburgh.

This belting is formed of vulcanized India rubber, combined with cotton duck or fibres of cotton.

83. Hand Planing Machine; Muir and Co., Britannia Works, Manchester.



This machine is especially intended for the use of philosophical instrument makers, having been designed at the suggestion of Mr. Andrew Ross. It is worked by a continuous rotary motion, and is adjustable up to 1ft. 3in. long, 1ft. 3in. wide, and 1ft. high. It produces an almost uniform motion by means of a pair of elliptical wheels, and there is treble speed in the return motion.

84. Revolving Planing Machine; T. Gehrling, 15, William-street North, Caledonian-road.

This machine is principally intended for circular work, where the weight lies in the centre. The work may be easily fixed in it, either for planing or polishing. This model is combined with an eccentric chuck for ornamental surface-turning. The machine is made self-acting by an endless screw, so that when the handle is turned, the tool slides along the surface.

85. Patent Thermo-pneumatic Lubricator; Samuel Bickerton, Lower King-street, Oldham.

This lubricator depends for its action upon the expansive effect of heat and on the pressure of the atmosphere. When the lubricator—being about two-thirds charged with oil—is in close contact with a journal of a machine, a slight increase of temperature from the friction of the shaft will cause the air and oil to expand, and a portion of the oil to drop down. When the temperature falls the air and oil contract; a quantity of air is forced in, and the lubricator is thus again ready to act. The instrument thus becomes self-acting. Fig. 1 shows the lubricator itself, and Fig. 2 the method of fixing it.

Fig. 1.
Lubricator.

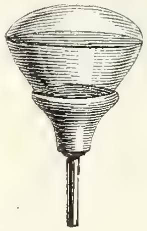
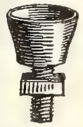


Fig. 2.
Fixing.

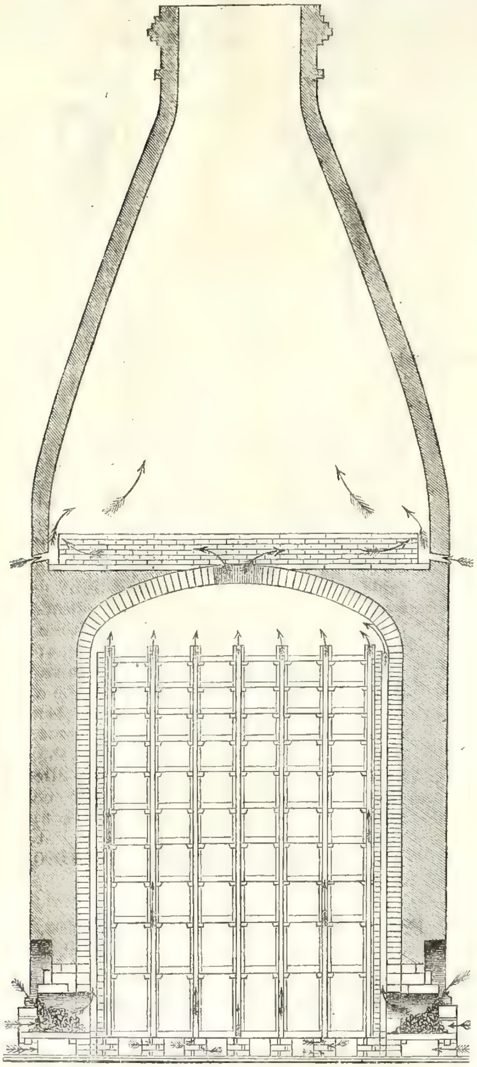


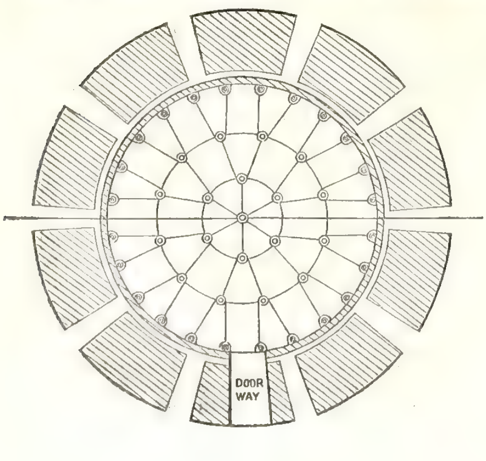
86. Patent Brick, Tile, and Pipe Moulding Machinery for Stiff Plastic Clays; Wm. A. Smith, Belper.

This machine receives its clay from a hopper, by means of two pressing or grinding rollers, which force the clay through a perpendicular channel into moulds fixed in a frame with two sets of moulds, open at top and bottom, which vibrate to and fro from the channel to the pistons on a stationary bottom plate or moulding table, which is fixed at a clay-tight distance from the aforesaid channel. One set of moulds being filled with clay or bricks, is then drawn back under one of two sets of pistons; at the same time the empty moulds from the other side of the frame are brought under the channel to be refilled, while the bricks are being discharged out of the moulds by the pistons on to pallet-boards, at the same time that the empty moulds under the channel are being filled with clay by the action of the rollers, the continued action of the machine producing two continuous streams of bricks, three on each pallet-board. This machine is stated to produce 25,000 bricks in 10 hours.

87. Patent Kiln for Burning Stoneware, Clay-ware, Porcelain, and other kinds of Earthenware; John Cliff. Messrs. S. Green and Co., Imperial Potteries, Lambeth.

In the use of this kiln there is great economy in fuel: this is effected by means of the hollow columns, bottom and annular flue dividing the flame and heat equally over all portions of the kiln. There is also economy of time, since the kiln can be fired oftener and drawn and set more speedily. Economy of space is also effected by the peculiar arrangement of horizontal quarry floorings supported at regulated intervals by collars built into the hollow pillars—rendering the interior of the kiln available to a far greater extent, for the introduction of ware, than the ordinary kilns. By simply removing the door way slab and three slabs right and three left in the middle row of each tier—the workman has easy access to every portion of the kiln, and the usual building up and pulling down of the central portions of common kilns is avoided. There is greater cleanliness, as when this kiln is closed for firing, no flame or dust can approach the ware, the colour and body of which is safely regulated by the equal distribution of heat which the interior sustains. The same means that effect the rapid gain of heat, expedite the cooling and that with equal regularity. The stunting of the ware, by sudden changes of temperature, is much obviated by the deflecting top, and the flow of cool air between the inner lining and the lining of the kiln—under the bottom and up the hollow pillars—but not upon or through the goods. Other advantages are a more perfect combustion of smoke by the increased distance it has to travel, and the large surface it is necessitated to pass over, the air being admitted as required by the flue over the fire-place (seen in section of model), which is closed and opened by sliding bricks. It is again met by currents of fresh air at its exit from the edges of the deflecting floor; and when the kiln is hot, the combustion at this point is very preceptible.





88. Parson's Patent Machinery for producing and revivifying Animal Charcoal; E. Eyre Ashby, 61, Coleman-street, E.C.

This apparatus consists of a circular air-tight case, within which (at the lower part) are furnaces, with flues extending round the inside of the case, and communicating with a shaft. Over the surfaces and flues is placed a revolving metal disc or hot plate, with an aperture towards the centre. On either side of the furnaces and flues (within the case) are fixed troughs containing sand, which run round the whole circle of the inner and outer sides. Rims or flanges are affixed to the underside of the hot plate, so as to revolve in these troughs. This arrangement prevents any passage of air to the upper surface of the plate. A feeding hopper (fitted with slide to prevent access of air) supplies the matter to be operated upon to the surface of the plate. Spreading rollers, distributors, &c., are fixed at the required height above the plate, to the upper parts of the case, and a sliding scraper is so adjusted as to be capable of quickly discharging the whole of the matters through the central aperture into a receiving chamber in the lower part of the machine. Ventilating pipes, with valves, are fitted into the cover, to provide for the escape of steam and gases. Motion can be communicated to the revolving plate, or to a shaft carrying it, by a simple mechanical arrangement, which does not interfere with the perfectly air-tight condition of the upper chamber or retort.

89. Patent Mill-Stone Staff; John Maninng, Boyne Engine Works, Leeds.

This instrument may be applied to any flat object as a test of the truth of its surface, but is more particularly applicable to mill stones. It is intended to avoid the risk of marking the low as well as the high places on the mill stone, as often occurs with the ordinary staff. Three small pieces of cast-iron are let into and below the surface of the mill-stone; these are drilled, and receive the points of the adjusting screws or feet which carry the lower of two metal discs resting one on the other, their surfaces in contact, being made perfectly true. The upper disc carries the staff itself, which is again made adjustable by four set-screws. The boss on the upper disc receives a trail-rod, with a thimble screw in the end of it. The hole in the centre allows the mill spindle to pass through. In using the staff the two discs are set on the stone without the staff itself; the three lower screws are adjusted until the point of the trail-rod screw, in passing through the circle, touches the face of the stone at the four quarters. The face of the staff is then dressed with a colouring substance, and placed on the upper disc; the screws are lowered till the staff touches the stone, when one revolution will mark all the high places; these are dressed off in the usual manner, and the operation repeated till a perfectly true surface is obtained. When once set the instrument may be lifted on and off a mill stone as often as desired, without further adjustment; or the staff only may be removed, and the discs left standing until the operation of dressing is complete. The staff may be modified to suit conical mill stones of any angle, and will obviate the great difficulty hitherto experienced in dressing them.

90. Patent Hydraulic Lifting Jack; Daniel Adamson and Co., Newton Moor Iron Works, Hyde, near Manchester.

This apparatus is composed of two main parts, the lower and outer side-case or cylinder, and the top and inner ram. A small inverted pump is fixed at the lower end of the lifting ram, which is worked by a lever and rocking shaft passing through the square head or top part, which top also forms a cistern to contain as much oil or water as will lift the ram the required height. When the jack is used for lifting, the oil contained in the head of the ram is forced into the outer case or cylinder at bottom, which causes the ram to ascend. When required for lowering, the lever is partly drawn off the working shaft until the second projection can come in contact with the head of the jack; by depressing the lever in this position, a quick or slow lowering motion is obtained without manual labour. It is stated that with this apparatus one man can do as much work as four men with screw jacks of equal power.

91. Registered Adjustable Bench-Vice; Easterbrook and Allcard, Albert Works, Suffolk-road, Sheffield.

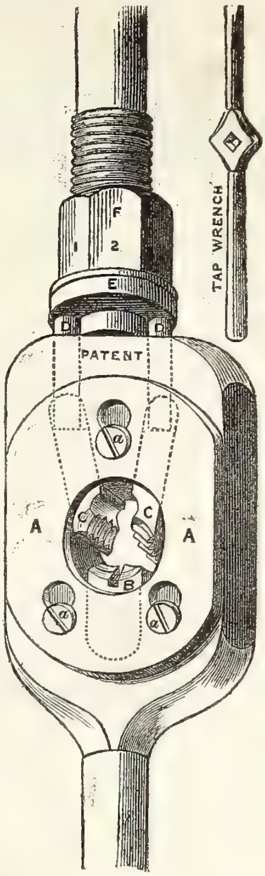
This vice has a ball and socket-joint applied to one of the legs, which allows the jaws to adapt themselves to any shaped object that a workman may wish to grip, however taper or conical, answering equally well for holding any parallel object.—(See *Mechanics' Magazine*, Nov. 20, 1858.)

92. Patent Ratchet Brace; Easterbrook and Allcard.

The peculiarity of this brace is, that it can be adjusted so as to bore at an angle, and in a position where a brace with a straight-sided ratchet wheel would be inapplicable.

93. Patent Direct Action Guide Screw Stocks; Chatwin and Taylor, 58, Broad-street, Birmingham.

By this stock screws of several sizes can be cut, without changing the dies, where one pitch of thread is used. Another advantage in this stock is that the dies can be taken out and ground, which cannot be done with the ordinary dies now in use.



94. Registered Pipe and Nut Wrench; W. Heap, Oldham Road Tool Works, Ashton-under-Lyne.

This wrench is designed for connecting or disconnecting the screwed joints of gas, water, or steam pipes, and for turning the nuts on screw bolts. The handle is formed with a screw-thread to receive a milled nut. A claw is formed on the end of the handle, and between it and the nut is a sliding collar, formed with lugs, to which is jointed the short lever, forming a moveable or loose jaw. The part of the handle on which the collar slides may be made square or hexagonal in form, or, if it is made round, it must be formed with a groove to receive a steadying pin fixed in the collar, to prevent the latter from turning round. A small spring is attached to the collar, to act against the loose jaw, and press it inwards, whilst the loose jaw has a projection which prevents its being forced too far outwards. The claw and loose jaw are serrated, so as to take a firm hold of the pipe: and by turning the milled head, the loose jaw is adjusted to various sizes of pipes.

95. Patent Picks, Mattocks, and Hammers; W. and C. Kaye, Howarth Works, Lockwood, near Huddersfield.

These tools have tapering eyes for the handles, which can therefore be readily fixed or removed. The employment of wedges to fasten the handles is rendered unnecessary by the use of a short screw bolt, or pin, which is found sufficient in these tools to keep the handle firmly in its place, and give increased power to the implement. The eyes are made of the same size and form, if of the same general class, to allow any handle to fit any eye.—See *Mining Journal*, August 14th, 1858.

96. Patent Rotary Refrigerator; W. W. Wynne, 5, Barr-street, Lower East Smithfield, E.C.

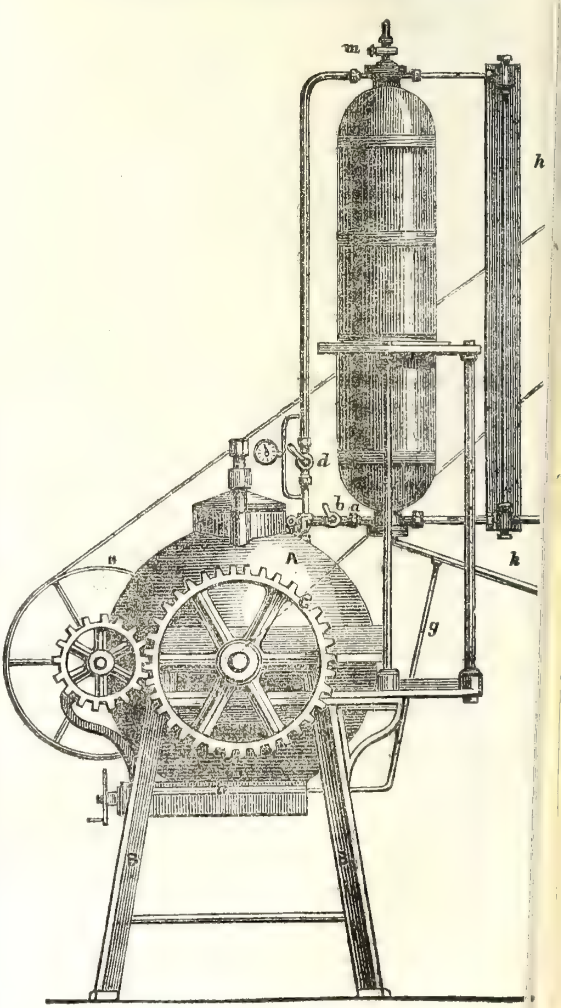
This apparatus consists of several tanks, in each of which is a tube passing backwards and forwards so as to form three arms or beaters, which rotate on an axis, this axis forming the main tube, and running the entire length of each tank. The liquid to be cooled or heated is placed in the tanks; and a cooling or heating fluid is made to pass through the pipes, which are then kept in motion.

97. Patent Regenerative Refrigerator; C. W. Siemens, 7, John-street, Adelphi, W.C.

The arrangement of this apparatus is such that a cold solution, nearly 30° degrees below freezing point, even in the hottest climate, may be produced by dissolving within it crystallized chloride of calcium in water, when both the salt and the water are at a temperature a little below 62° of Fahrenheit. The machine consists of an upright cylinder, or open vessel of copper, and is divided into several concentric compartments, the whole being surrounded by an iron case, between which and the outer copper cylinder is enclosed a quantity of some non-conducting substance (cow-hair). The salt which is made to fill the central chamber, is supplied to the machine through the open funnel from above, in sufficient quantity to supply the vacancy caused by the dissolving of the salt by a divided stream of water entering from below. The solution thus formed escapes from the bottom of the inner chamber, and ascends in the annular cavity surrounding the dissolving chamber, between double walls forming close concentric chambers, which are filled with water entering from suitable pipes at the top, and escaping from the bottom. This water may be used to supply the divided stream which enters the central cavity where the salt is dissolving, or to furnish a supply of iced water for household consumption. The refrigerating solution ascending between these double walls, abstracts heat from the water enclosed within them. The water in the lower part of these concentric walls, around which the salt solution first enters, will be cooled to nearly freezing point, and to a gradually less degree higher up as the salt solution ascends, and becomes itself warmer until it escapes through an overflow-pipe at a temperature nearly equal to that of the water on first entering the close chambers of the apparatus. The mass of salt, gradually descending in like manner, is being cooled by the surrounding fluid, and both the salt and the water being thus cooled down to nearly 32° Fahr. preparatively, it follows that the fresh solution, which is continually being formed in the central cavity, will be nearly 30° below freezing point, and will readily produce ice in the conical vessels, containing water to be frozen, which are introduced into the central cavity. These vessels may be removed for the purpose of being refilled at intervals of about twenty minutes, that space of time being sufficient to convert the whole of the contents into ice, except only when commencing the operation. In the space which occurs, within the machine, occupied by the solution of salt before it escapes, a number of bottles of wine, ale, or other liquor may be cooled in an equally short time. The solution of chloride of calcium may, from time to time, be recrystallised. The salt employed being thus recovered, ice may be obtained, after the original outlay, at the expenditure of fuel only. On the average this expenditure amounts to about one pound of coal for each pound of ice obtained; but in tropical climates the sun's rays alone are sufficient to effect the evaporation.

98. Patent Aerated Bread; Peek, Frean, and Co., Dockhead.

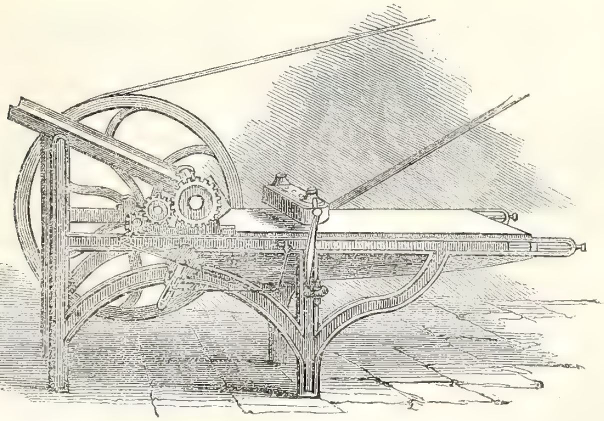
In this bread, as in the ordinary fermented bread, the vesicular structure is imparted by the expansion of carbonic acid gas within the



substance of the dough; but, whereas in fermented bread the carbonic acid is derived from the fermentation or degradation of a portion of the flour itself, in this bread the pure carbonic acid gas is superadded to the flour, which does not undergo any degradation whatever. A is the vessel in which the flour, water, and salt are mixed together. It consists of a very strong iron globe, 3 feet in diameter, capable of bearing a pressure of 300lbs. on the square inch; it has an opening at the top, to which an air-tight cover is fitted, and an opening at the bottom, also capaple of being closed air-tight. Through its centre a shaft or rod passes, on which are fitted iron mixing arms; this shaft or rod has the wheel G fitted to one end, in which a smaller wheel works, which smaller wheel is moved by the pulley H, which in its turn receives motion from a steam engine. L is the water vessel, made of copper, and tinned inside; the bottom of this vessel communicates with the vessel A by the pipe *a*, in which there is a stopcock *b*; the top communicates by the descending pipe *l*, in which is the stopcock *d*. To this copper vessel is attached a water gauge *h*, which marks the number of gallons drawn in or out of it. Through the bottom the pipe *k* enters, and terminates within by a rose. To work this apparatus, flour and salt are put into the vessel A, which is afterwards closed air-tight, and after exhaustion of the air contained in the vessels A and L, water is drawn into L through the stopcock *m*. Carbonic acid gas is then forced through the pipe *h*, and being discharged from the rose, bubbles through the water, rises to the top, and passes down the pipe *l* into the vessel A. By this means the vessels are filled with a condensed atmosphere, and the water is saturated at the same time. When sufficient fixed air has been forced into the vessels the stopcock *b* is opened, and the proper quantity of water is run into the flour. The mixing arms are then set going, and in from four to six minutes the dough is perfectly mixed. It is then drawn into pans or moulding baskets in the same way as soda water is drawn into bottles, &c., and is passed into the oven without being touched by the hands. During the drawing the carbonic acid gas, dissolved by the water while under pressure, is evolved, and by its expansion raises the bread.

99. Bread-Making Machinery; John Miller, Upper George-street, Edgeware-road, W.

The machine exhibited is that portion of the machinery, which forms the dough into loaves, as shown in the wood cut. It consists of a sloping platform, which delivers the dough into a pair of steel rollers working horizontally at the end of it, capable of adjustment at any suitable distance. After passing through these rollers the sheet of dough falls on an endless web revolving horizontally, which, by means of a simple mechanical arrangement, is carried step by step the exact space required for the cutter, which stamps out the loaves in succession as it is carried along the web. The pieces of dough thus cut, which are not more than three-quarters of an inch thick, are set side by side on flat tins, and placed in a warm atmosphere for about thirty or forty minutes, until the dough has risen somewhat, when they are put in the oven. The other machinery used by Mr. Miller comprises a mixing machine and a kneading machine. The mixing machine consists of an iron cylinder, through which a horizontal axis passes, having a series of beaters, or blunt knives, fixed at right angles to it. Each knife or beater is bent round, in the form of an oblong parallelogram, which extends from the axis to within a short distance of the inner surface of the cylinder. The cylinder is stedfast, while the axis carrying the beaters revolves inside. The materials for making the bread are placed inside the cylinder, and in a very short time, by the action of the machine, they are thoroughly mixed. The kneading is performed by passing masses of the mixed material, after it has stood a sufficient time, through a pair of steel rollers several times, and thus it becomes kneaded and thoroughly amalgamated into a uniform dough, suited for passing into the machine exhibited, which forms it into loaves. (See *Journal of the Society of Arts*, vol. vii., p. 236.)



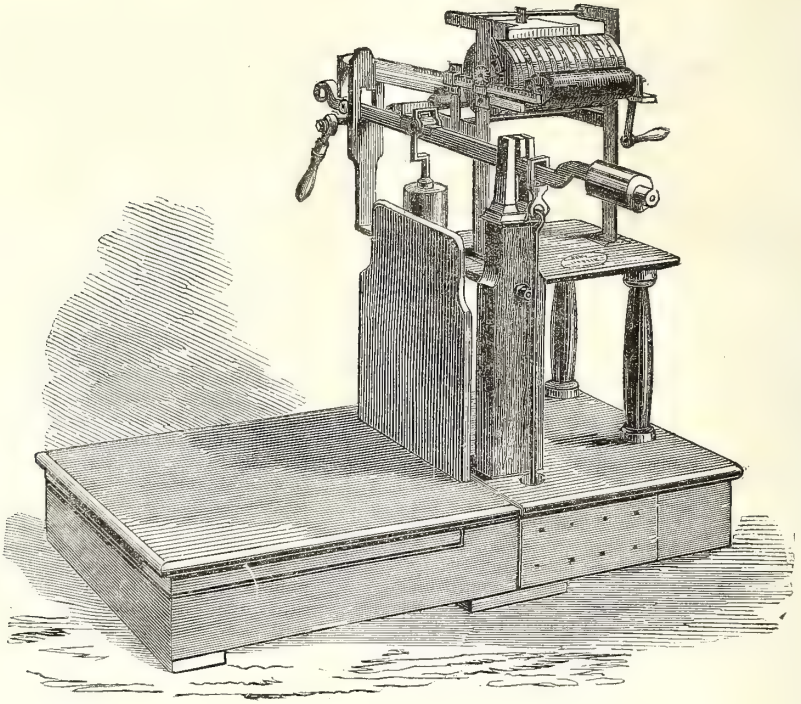
100. Patent Bread-making Machine; E. Stevens, 5, 6, & 7, Cambridge-road, N.E.

This machine has a double bottom for containing hot water in cold weather, to regulate and force if you wish the sponges and doughs, avoiding the necessity of using so much hot liquor, which is injurious to the bread. In very hot weather this chamber can also be used for cold water, to keep the sponges and dough cool, which always generate heat in fermentation, (particularly in hot weather); this application of cold water will cause the fermentation to work gently, producing better bread. The mixer is kept in its place by means of the pawl, which has only to be raised, when the mixer is taken out of the machine; by this means the trough is perfectly even and smooth inside in every part.

101. Patent Kneading Machine; Charles Quintin, Cheltenham.

In this machine a horizontal shaft traverses the entire length of the interior, to which are attached beaters, &c., which in their revolving beat the flour into a dough, incorporating the yeast, flour, and water. The process of kneading a sack of flour or 5 bushels, 280lbs., is stated not to occupy more than six minutes.

102. Porquerée's Patent Self-registering Weighing Machine; Burgess and Key, 25, Newgate-street, E.C.



By means of this contrivance, any quantity of weights can be registered with accuracy, however illiterate or negligent the attendant may be. The paper-board can be so shifted that any new and distinct series of figures can be registered. The moment the exact weight is ascertained, it is printed on the paper, without the possibility of a mistake, and the figures so printed are so regularly arranged, as to be cast up without the least difficulty.

103. Sample Bars of Cast-Steel, suitable for turning-tools, files, chisels, and other cutting instruments; Henry Bessemer and Co., Sheffield.

This steel is produced direct from molten pig-iron, by the "Bessemer Process," which consists in forcing a blast of air through the fluid metal for a period of 10 to 12 minutes, whereby the pig-iron so treated is converted into steel without any manipulation or the employment of fuel. After the conversion of the crude iron into steel, it is poured into water for the convenience of dividing the steel into fragments, it is then remelted in the usual manner, cast into ingots, and tilted into bars of the desired size and form. (For an account of the process, see *Journal of the Society of Arts*, Vol. v.)

104. Machine-twisted Iron; John Reynolds, 57, New Compton-street, W.C.

The advantages over the ordinary twisted iron are that, being worked cold, greater accuracy in the twist and sharpness of outline are secured. It is usually produced in 12-feet lengths.

NAVAL AND MILITARY APPLIANCES.

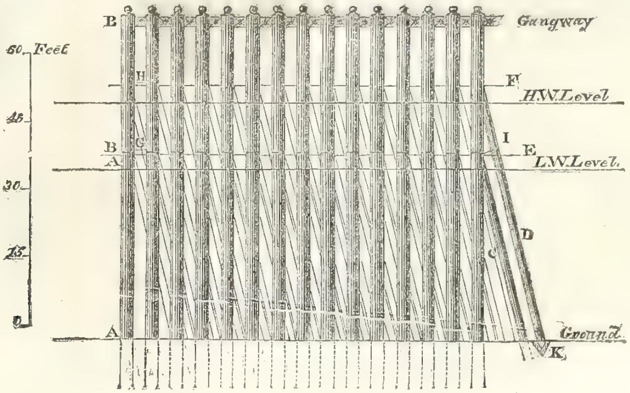
(For the remainder of the Articles in this Section, see Drawings.)

115. Permanent Groyne, for the Sea Coast; Edward Manico, Lieut. R.M., 4, Barge-yard, Bucklersbury, E.C.

The model exhibited, representing 100 feet in length, and 30 feet in width, on a scale of 6 feet to an inch, is intended to show how the *caissons de fer*, viz., hollow fabrics of iron, each a cube yard, filled with stones, may be used in the construction of permanent groynes, for gathering, and retaining the beach, as a protection to all parts of the coast exposed to the ravages of the sea; also its adaptation as a temporary breakwater or fender, behind which the outworks of piers and harbours may be safely carried on; and the banks of canals or rivers, liable to disruption, rendered safe.

116. Wave Screen; E. K. Calver, R.N, Admiralty Surveyor, 16, Roker-terrace, Sunderland.

This structure consists of nine principal parts, and is disposed in two courses, offering alternate spaces, which extend from the bed of the sea to above the highest level of the water. It is intended to supersede the stone breakwaters, and is designed in accordance with the belief of the non-percussion of the main-mass of deep-water waves, or undulations, and its effect (as proposed by the inventor) would be to afford sufficient protection to vessels anchored under its defence, and at the same time, in accordance with well-known laws, to render the space enclosed by it permanent in depth. (See woodcut.)



117. Diving Dress, with Apparatus for Facilitating Breathing under Water; J. White, Finchley, N.

This apparatus consists of a metallic covering, fixed closely round the nose and mouth by means of a band fastened round the head. In connection with this covering, there are two pipes, each provided with a valve, one with an inlet valve for the supply of fresh air, the other with an outlet valve for the passage of the air exhaled from the lungs. Two pipes, which are fastened by a bayonet-catch, are attached to the ends of these pipes in the mouth-piece, and the other end of each of them is turned downwards and fixed in the upper part of a vessel so constructed that it will float on the water, and admit air into the lungs, but prevent the admission of water. This vessel consists of a funnel, covered with perforated tin. Into the larger part, the tubes before-mentioned are fixed, and the whole is supported in an upright position, and partly immersed by means of weights attached to the lower end, and floats to the upper. All water thus entering by means of the perforations escapes down the tube. In communication with the pipes, are compressible and expansible chambers, capable of being operated on at the will of the diver, as a means of increasing or decreasing his buoyancy, and so enabling him to ascend or descend in the water.

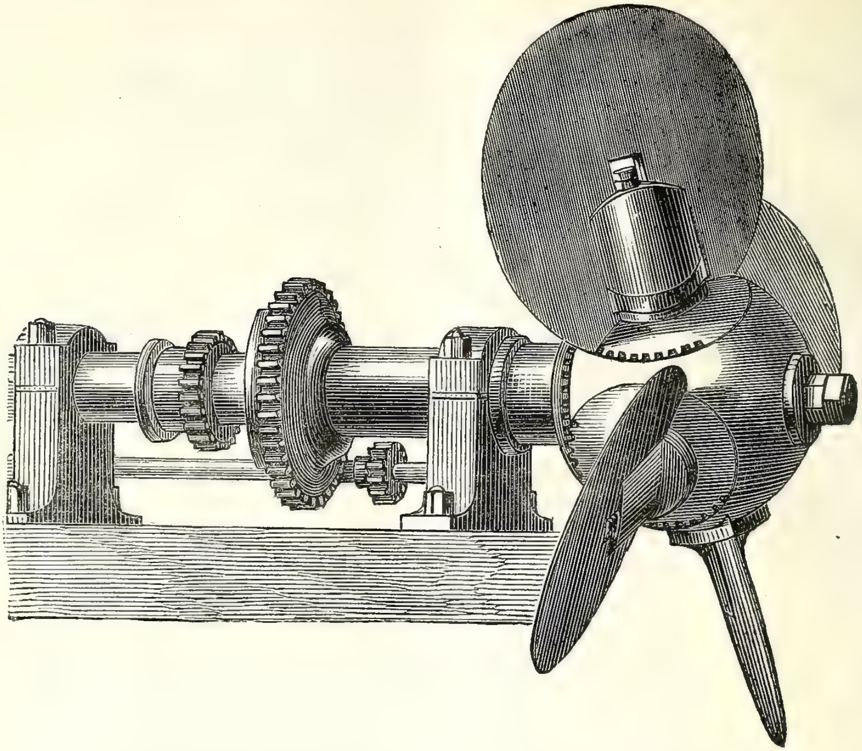
118. Apparatus for Examining and Repairing Dock Gates; B. Hocking, Gateshead.

This apparatus is designed for the purpose of enabling dock gates and their machinery to be examined and repaired without interrupting the business of the dock or canal.

119. Patent Improved Screw Propeller; Robert Griffiths, 69, Mornington-road, N.W.

The improvements in this propeller over former patents, consist in the method of securing the blades on the boss by the strong malleable iron cotters, which both firmly secures the blade, and is also the means by which the pitch of the screw is to be altered. Wood blocks are placed on each side, which are readily adjusted. The other improvements consist in curving forward towards the vessel the outer parts of the blades.

120. Patent Royal Alfred Feathering Screw Propeller; William Hewitt, Bristol.



In this propeller the fans are capable of being adjusted so as to enter the water at any desired angle. This is accomplished by making the fans, which have each a convex seat, with a rack on a portion of their periphery. The seats of the fans fit closely into their bed, on the spherical head of the screw-shaft. When it is desired to shift the angle of the fans, a toothed-gearing on the shaft is caused to work into the rack on the seats of the fans, and this is accomplished from within the vessel. The fans are made quite flat and circular, and are said to enter and deliver themselves without any apparent disturbance of the water, also obviating to a very considerable extent what is denominated the slip of the screw. This screw can be constructed either with two, three, or four fans, which can be worked with perfect safety at any angle, there being no diminution in strength at whatever position it is found desirable to set them to, neither can it get deranged by a sudden reverse or backward motion. Another feature is, that a disabled fan can be immediately removed and replaced by another, without having to remove either the boss or shaft, or placing the vessel in dock. The trunk, or chamber provided for lifting the screw out of the water is entirely dispensed with.

121. Vertical Propeller; Thos. Spiller, 5, Red Lion-square, W.C.

This Propeller, in its action on the water, is very much like the tail of the whale, dolphin, or porpus, fish that swim on the surface of the water. Its motion is vertical, the propeller assuming in its descent and ascent through the water, an angle which may be made to vary according to the velocity of the vessel or resistance of the water. It is adapted for an auxiliary to fast-sailing vessels, being no impediment to the vessel's progress through the water when under sail alone, and it does not in any way interfere with the action of the rudder, or the steering qualities of the vessel. Its action is in a direct line with the keel of the ship; it is suitable for any depth of water or amount of steam power. The fins being horizontal, it is stated that they will give as much propelling force in seven feet of water as the screw in 27 feet. The propeller may be applied in any part of the dead wood of the keel, not so near the rudder as the screw.

122. Screw Propeller; George Pringle, Preston Grange, Prestonpans.

123. Ship Propeller; Greenwood, 23, South Audley-street, W.

The wheel is furnished with float-boards made with bevelled edges, and revolving freely on a single axis. By these means alone the float-boards are kept square to the line of the vessel's keel when freely worked in the water. They have then only to be kept edgewise in the case of the wheel until they are required to act, which is at the lowest point on each side of the keel. Thus the float-boards only work when they arrive at the most effective point for propelling the ship; and, however rough the sea may be, or the ship rolls, they even act in a deep and solid mass of water.

124. The Life-Boat of the Royal National Life-Boat Institution; 14, John-street, Adelphi, W.C.

Fig. 1.

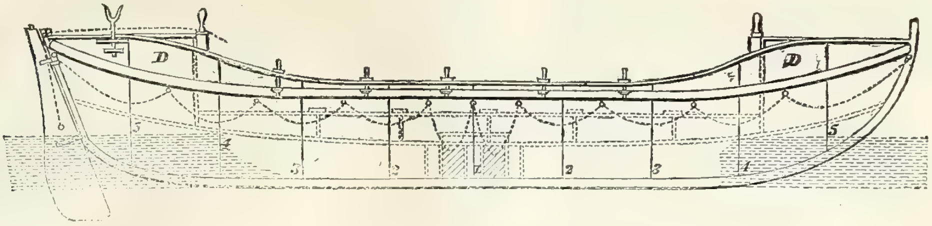
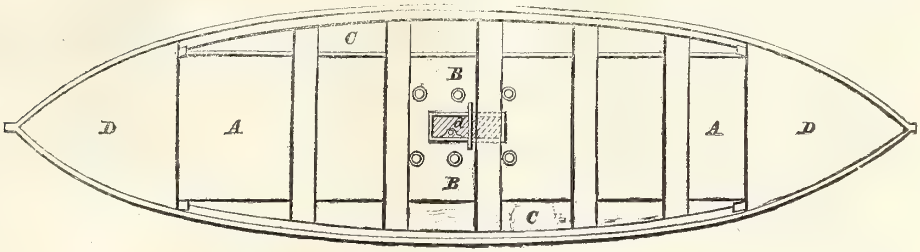


Fig. 3.



The accompanying figures show the general form, the nature of the fittings, and air-chambers of one of these boats, 30 feet in length and 7 feet 6 inches in breadth. In figs. 1 and 2, the elevation and deck plans, the general exterior form of the boat is shown with the sheer of gunwale, length of keel, and rake or slope of stem and stern-posts. The dotted lines of fig. 1 show the position and dimensions of the air-chambers within board, and of the relieving-tubes. In fig. 2, A represents the deck, B the relieving-tubes (6 inches in diameter), C the side air cases, D the end air-chambers. In fig. 3, the exterior form of transverse sections, at different distances from stem to stern, is shown. Fig. 4 represents a midship transverse section, A being sections of the side air-cases, B the relieving-tubes, bored through solid massive chocks of wood of the same depth as the space between the deck and the boat's floor. C, C, are spaces beneath the deck, filled up, over 6 feet in length, at the midship part of the boat with solid chocks of light wood, forming a portion of the ballast; *d* is a section of a small draining-tier, having a pump in it, by which any leakage can be pumped out by one of the crew whilst afloat. The festooned lines in fig. 1 represent exterior life-lines attached round the entire length of the boat, to which persons in the water may cling till they can be got into the boat; the two central lines are festooned lower than the others, to be used as stirrups, so that a person in the water by stepping on them may climb into the boat. This boat was designed by Mr. James Peake, Master Shipwright in H.M. Dockyard, Devonport, and built by Messrs. Forrest, of Limehouse.

Fig. 3.

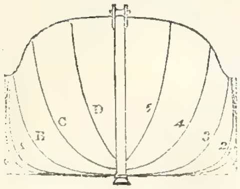
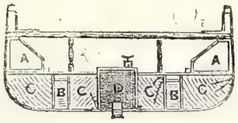


Fig. 4.



125. Twin Life Boat; A. Baker, 63, Nelson-square, Blackfriars, S.E.

This boat is stated by the inventor to be also suited for use as a gun-boat.

126. Apparatus for Saving Lives from Stranded Vessels; Captain Thomas Kisbee, Royal Navy.

This apparatus can be constructed from materials in nearly all cases at hand on board ship.

127. Improved Boat; Thomas Sutton, St. Brelade's, Jersey.

This model represents a boat constructed entirely of straight timber. The mode of construction is not only economical, but the greatest possible amount of speed and stiffness under canvass is stated to be secured by it. The great length prevents leeway, at the same time that the draught of water is small compared with what is usually thought necessary to a boat of the same size. Vessels of any size may be constructed on the same principle, the length being of course increased in proportion to the beam, and the height of the masts depending on the beam of the vessel at the part where they are stepped, and not upon the length. The model is made to the scale of one inch to the foot.

128. Patent Ship's Cabin Ventilator. William Chadwick, Bury, Lancashire.

This consists of a smoke-jack, placed horizontally in a small chimney above the cabin lamp, surrounded by a cowl formed of spirally curved plates.

129. Patent Keel Buoy; B. Stoney, 89, Waterloo-road, Dublin.

This buoy has a circular keel, formed by the prolongation of the sides below the bottom, and contains a large volume of water whose inertia impedes the rolling tendency of the buoy when under the influence of waves. The buoy floats upright in tideways, as currents exert equal lateral pressure above and below the mooring ring. The keel acting as ballast in the most favorable position for stability permits a conspicuous superstructure to be reared above water.

130. Lee's Water Tank and Life and Treasure Buoy; Lansing, Starr, and Co., 74, King-William-street, E.C.

This invention consists in so arranging the water tank of a vessel, as to float out in case of shipwreck, its contents being first immediately discharged down to a certain point, by a single individual standing upon deck, the water below the point indicated being retained for the use of the shipwrecked. It is constructed of boiler plate iron, rising above the upper deck some four feet, and diminishing downwards to where it is attached to a chest or safe, for treasure, mails, &c., which rests on the middle deck, this form giving it an easy exit from the vessel, whatever be the position in which it may go down. When afloat, the chest or safe acts as ballast, and keeps it in a vertical position. Ordinarily it fits securely into a hatchway, which is protected against leakage by a flange surrounding the buoy, and resting upon the deck, after the manner of the combings of a hatch. In case of necessity, the flange is the foot-board on which the passengers and crew stand, to secure themselves by guards, lashings, &c., to the body of the buoy. The interior is divided into several compartments. (See Drawing No. 432.)

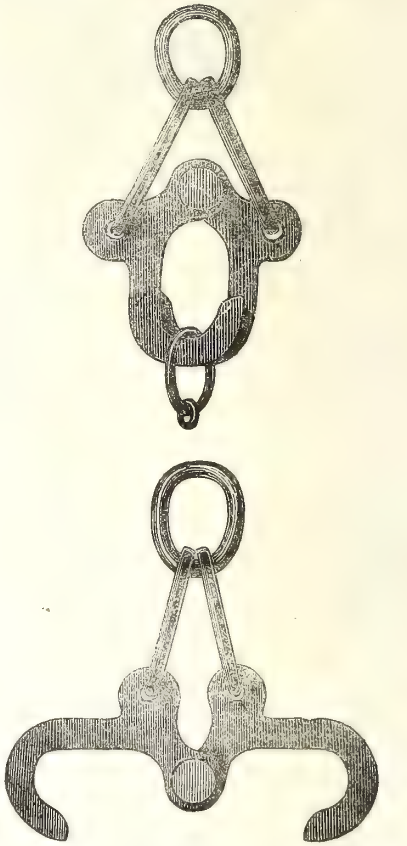
131. Gresham's Patent Record Buoy; George and Joseph Oliver, 286, Wapping, E.

This Buoy is intended to be kept in some place available for instant use, and to be thrown overboard from a sinking ship, or a vessel on fire, so as to intimate disaster, having a paper inserted therein. It has capacity and buoyancy to contain, besides these, the log-book, and several pounds' weight of papers or valuables. It is lined with cork between the cylinder and outside case, so that, although waterlogged, it will not sink, but keep afloat probably for years. In order to distinguish it from any other floating substance, so that the captain of a passing ship may recognise it as an intimation of disaster, it has, raised conspicuously upon its surface, a silvered globe, which, owing to the reflection of the light, will make it visible a great distance.

132. Patent Anchor, with Oscillating Arms; Samuel Hunter, Newcastle-upon-Tyne.

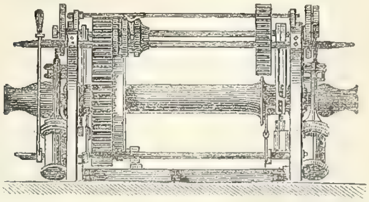
This invention consists simply in enclosing the palm within the arm, and keeping the latter open—the sides being parallel—up to the crown, so as to allow the earth to rise and pass over the palm and through the arm in a solid state, which arrangement gives greater strength and holding power. In the important property of canting, it possesses great advantages; it being almost self-acting, for it meets with no obstruction from the palm, as in other anchors; the curve of the arm being in uninterrupted contact with the ground until it rests on the toggle, removing the chief objection to anchors on the oscillating principle. The open arm gives perfect freedom in the oscillation, and removes all liability for stones to lodge in the throat. In tripping or weighing, notwithstanding its great hold, it is easily liberated, and leaves the ground quite clean. In fishing no shackle is required; the open arm leaving every facility for the hook to bring the anchor up, and secure the cathead, the enclosed palm rendering the operation much less difficult, at the same time protecting the bows and painting of the vessel from injury.

133. Patent Self-Detaching Hook; Major the Hon. Wm. Talbot, 27, Chesham-place, S.W.



The object of this invention is, that the hooks attaching boats should be so formed that as soon as the weight of the boat is removed therefrom, by contact with the water, the hooks may be self-releasing. Each hook or support forms a lever, one end of which is connected by a pin joint to the corresponding end of the other lever, and at the point of their suspension they form two separate links which hang from a ring common to both. The lower ends of these levers are bent into the form of a hook, and are capable of lying one across the other. When a weight is hung to the hooked end of the levers, and they are caused thus to cross each other, in that position they form a secure support. But as soon as the weight is relieved therefrom, these levers open or separate at their hooked ends, and clear the ring or other attachment by which they held the weight. Supporting connections thus formed are applicable as self-acting releasers when lowering merchandise, minerals, &c., and thereby save labour. (See *Practical Mechanics' Journal*, December 1, 1858.)

134. Patent Double Cylinder Steam-Winch; James Taylor and Co, Britannia Works, Birkenhead.



These winches have two cylinders, bolted to the frames; thus a fly-wheel is dispensed with. They are made of different powers, with cylinders from 5 to 10 inches and upwards in diameter, and are fitted with single and double purchase, for quick and slow motions as required, the clutch lever being so arranged as to throw one pinion out of gear at the same time that it throws the other pinion into gear, thus preventing the possibility of derangement. The spur-wheel is fitted on one end of a barrel shaft, carrying a friction wheel with strap, which is operated upon by a foot lever. A small boiler is placed in any convenient part of the ship, and the steam-pipes leading to the winches are usually carried immediately below the deck, with a branch leading into the different holds, and a stop cock. This can be used with effect as a fire extinguisher, without causing a ship's cargo to suffer unnecessary damage, as by the ordinary method of scuttling.

135. Slings for Raising Sunken Vessels in Deep Water without Divers: Edward Austin, 2, Trafalgar-square, Greenwich, S.E.

This model illustrates the arrangement of the chains for forming the slings.

136. Balestrini's Electric Sound; Perreaux and Co., 39, Mark-lane, E.C.

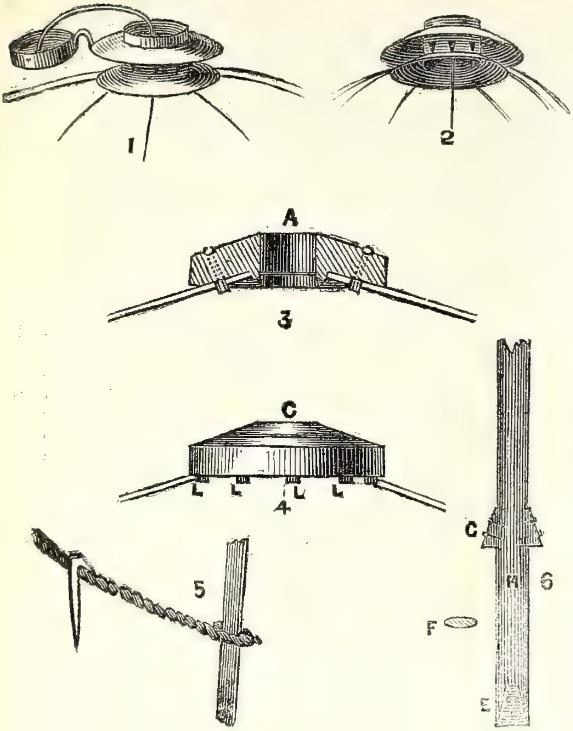
In this apparatus there is a plummet connected with wires leading to a battery, in such a manner that upon the plummet reaching the bottom, a part of the apparatus shall rise or fall, so as to make or break the electric current, and cause the ringing of a bell, or give motion to some other electric indicator. Upon this indication being observed, the line will be examined and the depth read off. See drawing, No. 433, which represents a section of the instrument. A, is a cylinder of cast-iron or brass; B, is a wrought-iron piston within the cylinder A, having a hole drilled through it in the position and direction of its axis; C is a cylinder of hard wood, the outside of which is furnished with two rings of brass and platinum combined; D is a double spring of plated steel, serving to establish the electric communication. This spring is insulated at bottom by an ivory or other suitable support. E is a wrought-iron rod, hollowed at F, at the upper end, and closing the bottom of the cylinder A, to which it is secured by screws. This rod, E, carries at its lower end the foot of the instrument, above which it receives the weights used for ballasting the instrument. In the bore, F, is placed the piston, G, and from the said bore lead out four apertures, *f f f f*, which allow the internal and external pressures to be equalized, and permit of the displacement of water caused by the descent of the piston, B. The body of the instrument is filled with oil, water, alcohol, or some other non-conducting liquid through the hole, H, which the piston, G, prevents from escaping when the instrument is thrown into the sea. If there be too much liquid in the body, the piston, B, must be depressed, by which means the piston, G, will be forced down below the apertures, *f f*, through which the excess will escape. Two electric conducting wires, covered with silk, pass into the instrument through the hole drilled in the piston, B. One of these communicates with the upper ring on the cylinder, C, and the other with the lower ring. When the instrument descends, the double springs bring the two rings into connection, and thus establish the electric current. When the foot of the instrument touches the bottom, the piston, B, continuing to descend, the springs are both brought to bear upon the upper ring, whereby the lower ring is insulated, the current broken, and the signal consequently given.

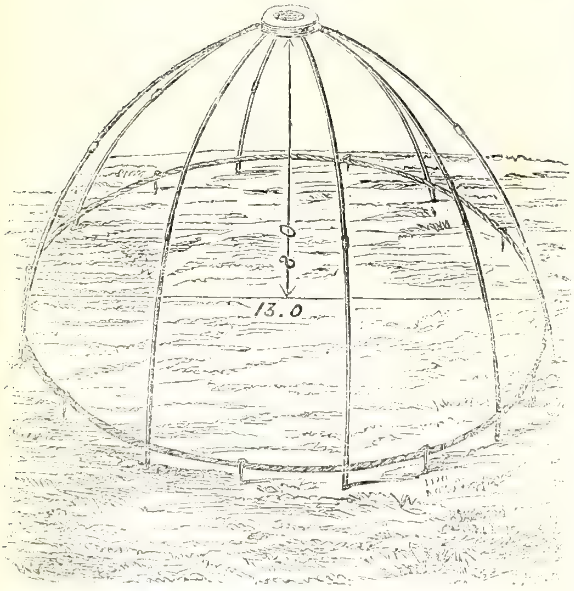
137. Lumb's Squeegees; Perreaux and Co.,

This apparatus is for the purpose of cleansing ships' decks, railway platforms, boarded floors, &c., and combines the deck scrub and swab in one. The scrub is made of bristles, of an improved shape, and wears evenly all over, and the swab is formed of vulcanized india-rubber.

138. Patent Improved Field and Hospital Tents; Major Godfrey Rhodes, Unattached; Messrs. Silver and Co., 66, Cornhill, E.C.

The canvas of these tents is supported by radial ribs, composed of wood, bamboo, or other suitable flexible material. The base ends of these ribs are forced into the ground, passing through metal rings, secured at equal distances to a series of pieces of galvanised wire (which is an improvement on the endless circumscribing cord or ground rope); this galvanized wire is secured to the ground by tent-pegs. The upper extremities of these ribs are bent inwards, and then inserted within metal sockets (for the field tent, to the central wooden head-piece, only) attached to the central wooden head-piece and ridge pole. The improvements in the hospital tent are, that the ridge pole is in one length, jointed at the centre, and secured (when used) by a sliding ferule or cylinder; the ground band is made of a series of galvanized wire lengths, having metal rings attached. Interior and exterior storm ropes are attached, being in direct communication with each other. Rifle loops are secured to the canvas of the tent, whereby two rifles can be supported (together with the accoutrements of two soldiers) at each rib of the tent.





139. Military Field Surgery; T. D. Rock, 8, Napier-terrace, Wellington-street, Islington, N.

This is an arrangement for securing prompt and efficient shelter and treatment for wounded soldiers on the field of battle. The vehicle is 7 feet long, 4 feet wide, and stands 6 feet high upon its wheels; it includes two amputation boards, drawers for dry drugs, shelves for bottles containing liquids, and pigeon holes for instruments, lint, plaisters, and other medical stores. A portable stone for heating water and nourishment is fitted at the end of the carriage, with two small boots for the smoke funnels; and in the front, under the driver's seat, are two drawers for containing the medical provisions. Attached to the vehicle is a capacious tent, which affords shelter from either sun or rain, and can be used by the surgeons as a habitation. The whole of this accommodation fits compactly together, can be drawn by two horses, and in ordinary campaigning would form a good substitute for the panniered mules usually attendant upon an army.

140. Patent Travelling Rotary Cooking Apparatus; J. Radley, 22, Upper Sackville-street, Dublin.

This apparatus is intended to cook for an army on the march, while accompanying the moving columns; a hot dinner being ready to eat the moment the halt is sounded. It is stated that a stove, 8 ft. by 2 ft. 6 in., will cook for 1,200 men in 2 hours. The tanks will contain water sufficient for breakfasts for 1,200 men. The bunkers will contain two days' fuel, and the range will burn any kind. Two attendants are sufficient to work it, the wheels of the carriage turning the meat, and two horses or bullocks will draw the whole with ease.

141. Patent Breech-loading Gun; Joseph Maudslay, Westminster-road, Lambeth, S.

This invention consists in forming each piece of ordnance with an opening through the breech at right angles to the barrel, and, by preference in a vertical direction, within which opening a breech piece is moved, so as at one time to be in a position at the end of a barrel, to have its charge of powder discharged through the barrel, and at another time opposite an opening through the breech, and in position to receive a cartridge, the hinder end of the barrel being then open to receive a ball or other projectile. The back side of the passage through the breech is slightly inclined, so that the moving breech may fit closely when in position to have the charge therein fired, and yet move freely in other parts of the opening or passage through the gun. It is preferred that the diameter of the bore of the moveable breech should be less than the barrel through which the charge is fired. The hinder part of the piece of ordnance opposite the end of the barrel is solid, and forms a solid end to the moving breech when the same is brought into the position to have a charge fired. The moving breech may be moved by rack and pinion, or by other convenient mechanism.

142. Rocket Gun; Henry Reveley, Poole, Dorsetshire.

In this piece of artillery the projectile takes the shape of a rude cannon cast with a bore, the touch-hole being drilled as usual. This projectile is fired from a wrought-iron pin loosely fitting the bore, which pin is itself held in a similar cast bore, but with closer fit. In the body of the gun is a lump of cast-iron of any shape, the larger the better. A line of sight is marked on the body of the gun, as well as across the touch-hole, on every projectile. The advantages are stated to be rapidity of discharge, because every projectile carries its own charge of powder, wad, and touch-hole, and stands ready at hand to be slipped on to the pin, requiring only to be primed and fired; safety, because each powder chamber is only used once; great economy of construction, because no turning or boring of cannon is required, as a very moderate fit will secure accuracy of aim; durability, because the pin can scarcely get damaged, and if knocked off by a shot from the enemy, can be replaced by a spare one in a few minutes. The body of the gun, being a mass of cast iron, may fairly be called indestructible. The inventor states that there is great increase of dynamic power from the explosion, because the same charge required to drive a round shot in the ordinary manner is, in the rocket gun, made to propel a mass forty or fifty times its weight. The report of a one-inch rocket gun is stated to be quite equal to that of a six-pounder fired in the usual manner, and a small charge is thus made to do the work of a larger, the form of the projectile being such as to ensure its generally going head first into the target. There is great destructive power on account of the enormous size of the projectile compared with the bore. The projectile may also be provided with a second chamber in the rocket head, carrying a bursting charge, liquid fire, or any other still more destructive material.

143. Liquid-Fire Rifle Shell; Capt. J. Norton, Rosherville.

This elongated wooden liquid-fire rifle shell, three and a half diameters of the barrel in length, is charged with a combustible liquid just before being used; the liquid, in about a quarter of an hour, will penetrate into the pores of the wood at the bottom of the shell, but not through the circumference of its body. On striking the object, a wedge-shaped plug, which closes the mouth of the shell, will be driven in, splitting the shell into many parts, each becoming a separate fire-brand, not to be extinguished by water.

144. Jacketed Rifle Bullet; Capt. J. Norton

The object of the jacket used on this bullet is to prevent the oxidising of the lead, thus preserving the shot of its requisite size, and preventing the poisoning of the wounds caused by this oxidation.

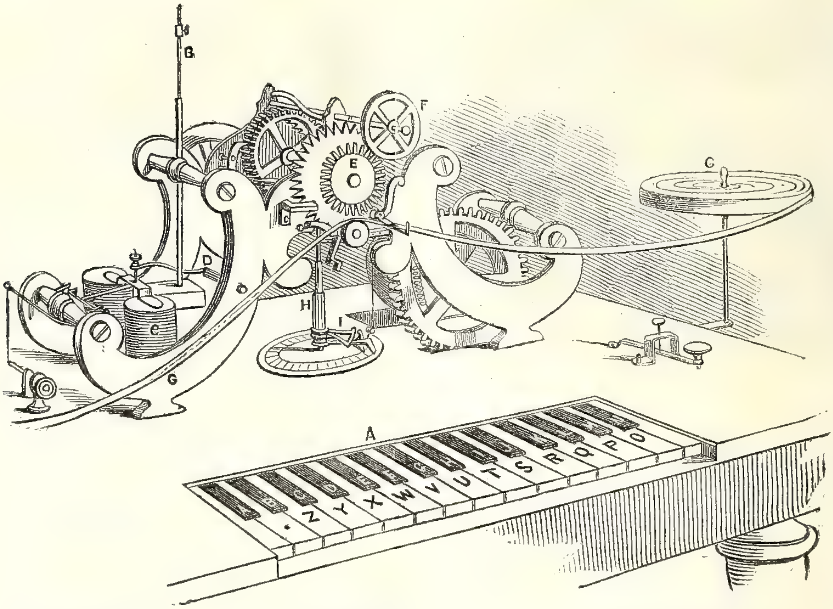
145. Expansive Shot; J. G. Tongue, Queen's-road, Bayswater, W.

This shot is conical, the body being of cast iron, with a ring of wrought iron at the lower end. Between the ring and the head of the shot a groove is formed, which is filled with lead.

PHILOSOPHICAL APPARATUS, &c.

(For the remainder of the Articles in this Section, see Drawings.)

156. Patent Roman-Type Printing Telegraph; Professor Hughes, 20, Northampton-square, E.C.



A. Key Board.
B. Vibrating Spring.
C. Electro-Magnet.
D. Detent.
E. Type-Wheel.
F. Ink-Roller.
G. Paper Printed upon.
H. Revolving Shaft.
I. Revolving Arm or Circuit Closer.

These instruments print any letter with one electric wave. They are governed and kept in unison by a vibrating spring, motion being produced by a weight acting upon a train of wheels. The printing apparatus is detached from the train of wheels, and only brought into action by the electric wave, which depolarizes the cores of a permanent magnet, allowing a spring attached to an armature, always resting on these cores, to rise, unlocking a detent by which the printing press is for one revolution attached to the train, and the desired letter printed. A is the keyhole; B, the vibrating spring governor producing synchronous motion; C, the electro magnet, the permanent magnet being below it; D, the detent.

157. Patent Self-restoring Telegraph Cable; Professor Hughes.

In this cable a non-conducting semi-viscid fluid is inserted between the layers of the gutta percha coatings, filling the pores, and perfecting the insulation of a good cable, while it oozes into and fills fractures of every description, whether caused by strain, chemical action, or accidents of any kind.

158. Telegraphic Cable; Captains Binney and Drayson, R.E. Woolwich, S.E.

This cable consists of a copper wire, of large sectional area, washed with a solution of pure india-rubber, over which, when dry, raw silk or wool is closely wound, and again washed over with the solution, so as to insulate the wire completely. When thus prepared the wire is enclosed in a tube of vulcanised india-rubber or other like material, large enough to leave a small air space around it. Small portions of the wire at intervals are formed into flat helical coils, by which means, combined with the elastic nature of the covering, any probable amount of extension required to meet a strain is provided for. The cable possesses great conducting power and perfect insulation, combined with only sufficient weight to allow of its sinking very gradually in the water, and a consequent absence of all risk from strain.

159. Balestrini's Telegraphic Cables; Perreaux and Co., Mark-lane, E.C.

The telegraphic wires are insulated by gutta percha, or vulcanised india-rubber, or they are enclosed in cords of hemp or other fibre, rendered waterproof by a mixture of india-rubber or pitch. The wires are thus protected from the core of the telegraphic cable; they are either laid parallel to each other, or spirally on a core of fibre, or of iron wire covered with fibre. Eight or any other number of cords of hemp or other fibre, waterproofed with the composition before-mentioned, are then closely wound in a spiral direction round this core, and the cable so formed is consolidated by passing it between grooved rollers. If the cable is intended for use under a considerable depth of water, it is strengthened by coiling round it (in the opposite direction to the coils of the cords) iron wires in long open spirals, and over these wires the cable is wound round closely with galvanised iron wire, and by the action of the galvanised wire on the non-galvanised wire a calcareous deposit is produced round the cable after it has been immersed some time, by which it is much protected. Sometimes, with a similar object, strips of zinc are laid longitudinally under the wire coating. In places where the cable is likely to come in contact with rocks it is protected by steel wire round it. To facilitate the laying of the cable a description of parachute is attached to it at intervals, which is so arranged that when the cable enters the water the parachute opens. Wires, suspended from posts or otherwise, are protected by being enclosed in cords of hemp or other fibre, waterproofed with the composition before mentioned, and afterwards painted zinc white. (See drawing, No. 423).

160. Patent Submarine Telegraphic Cables; John Walker, 17, Cowper-street, City-road, E.C.

In this cable the wire with its insulation is made, independent of the outer covering, which consists of an elastic tube of iron or steel wire. The tube is covered with wires, which run round it with a very gradual twist, so as to prevent stretching. The insulating material in some of the specimens shown is of india-rubber, coated with fine glass.

161. Platinized Graphite Battery; C. V. Walker, F.R.S., South-Eastern Railway. Robinson and Co., 226, Gresham-house, E.C.

This is a one-fluid battery, the negative plate being platinised graphite or gas carbon. The connection is made by electrotyping, soldering, and rivetting, all the copper employed being carefully tinned. The zinc plates are highly amalgamated, and stand in a little mercury contained in a small slipper of gutta percha, the liquid employed being weak diluted sulphuric acid. The advantage of this form of battery consists in its being cheap in construction and maintenance. It is stated that there is no form of battery more stable in its behaviour, more free from local action, or more fitted for standing long periods tranquil, yet always ready for action. These batteries, when once carefully charged, continue in good working order for ordinary telegraphic instruments, from six to twelve months, without any attention whatever.

162. Whitehouse's "Quantity" Battery. Robinson and Co.

A single cell of the platinized carbon battery, arranged for generating quantity, is shown. The amount of available excited surface of platinized carbon is 2,000 square inches, which can be arranged either as a single element for "one pair," or, if desired, can be in a moment divided by a glass partition and used as two pairs, each containing 1,000 square inches. The zinc plates may be removed and replaced without interrupting the action of the battery, and from the mode in which the contacts are made, the use of rivets or binding-screws for each plate is rendered unnecessary.

163. Improved Electrometer; Cornelius John Varley, 4, Fortess-terrace, Kentish Town, N.W.

This electrometer is contrived for the purpose of giving exact measures of electrical intensity, referable to a constant and easily obtained standard, so as to make observations taken at different places with different instruments comparable with each other. The instrument consists of a dial A, Figs. 1 and 2, insulated and supported

Fig. 1.

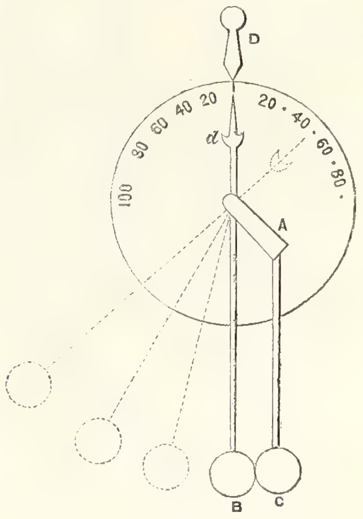
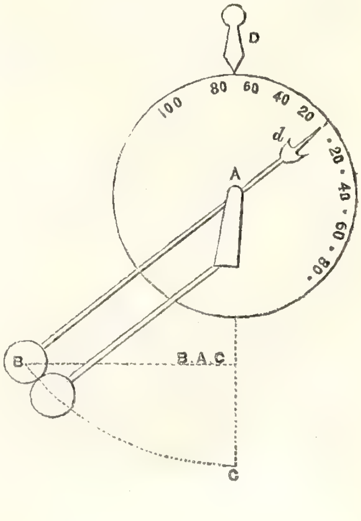


Fig. 2.



by a glass rod, and the whole capable of turning on its axis, as shown in Fig. 2. From the front of the dial two arms, B and C, are suspended, C being a fixture to the dial, and B moveable on an axis. Both these arms are terminated with balls, between which the electrical repulsion takes place when the instrument is charged. The two upper quadrants of the dial are divided, the right-hand one into 90 degrees, to measure the motion of the moveable index, and the left-hand quadrant into 100 unequal parts, to represent 100 equally increasing sines. These latter are pointed out by the fixed index D. The whole instrument is enclosed in a glass case, and all the glass supports varnished for better insulation. The mode of working it is as follows:—The instrument is to be so adjusted that when the zero on the dial plate is under the fixed index, the two pith balls hang just in contact, as in Fig 1. When the instrument receives an electrical charge, the moveable ball is repelled, as shown by the dotted lines, to distances varying with the intensity of the charge; the moveable index therefore shows, by the degree it points to, the difference of intensity in a rough way, though by experiment the exact value of each degree may be ascertained. To measure the force exactly, turn the dial round by the handle at the back till the fixed ball gradually approaches and just touches the moveable one, as in Fig. 2. In this position the gravity of the moveable ball is just equal to the repulsive power of the electricity, and as the gravitating force of a pendulous body is in proportion to its distance from the perpendicular (or, in other words, as the sine of the angle B, A, C), the sine of the degree indicated by the fixed index, exactly represents the amount of electric force with which the instrument is charged. The instrument which is considered the standard has the balls half an inch in diameter, and the moveable one so counterpoised as to preponderate with a force of one-tenth of a grain, but in an observatory there should be several instruments of different degrees of sensitiveness, some for measuring the more powerful charges, and the others for measuring the faintest electrical indications. It will be obvious that any number of instruments can be adjusted in the same way, and therefore the results of different observatories would be perfectly comparable,—an important result which has not been obtained by any other instrument, at least in the same degree. This instrument has further the advantage of being able to be carried about without deranging its adjustment, and is not liable to injury from an accidental overcharge.

164. The "Compensation" Self-registering Maximum Thermometer, as arranged for Deep-Sea Observations; Wentworth L. Scott, 7, Brunswick-terrace, Westbourne-grove, W.

This instrument consists of a glass tube, with a cylindrical bulb, containing mercury (as in the ordinary thermometer), at its lower extremity; but at the top the stem is drawn out, into a fine jet, bent at right angles, A. Fig. 1; in the interior of the second bulb, B. Fig. 1, this upper bulb is about half filled with mercury, the remaining space being a vacuum; near its base a platinum wire, *p*, is welded into the glass, and bent upwards, so that its point is nearly in contact with that of the jet. It is obvious that when the instrument is "set," *i.e.* the lower bulb and capillary tube to the point of the jet, completely filled with mercury

Fig 1

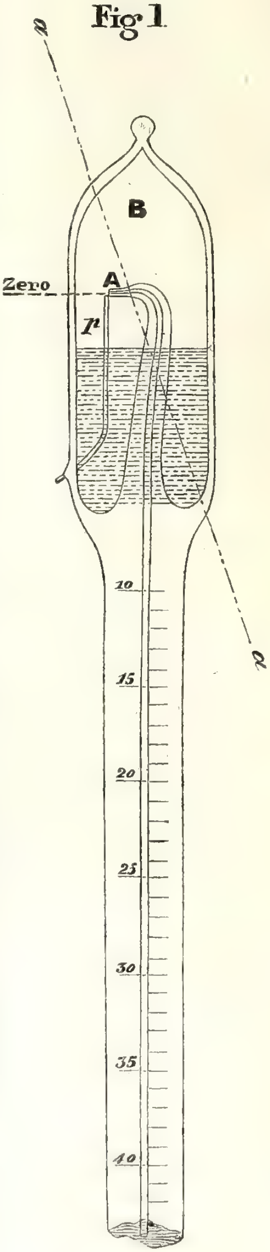
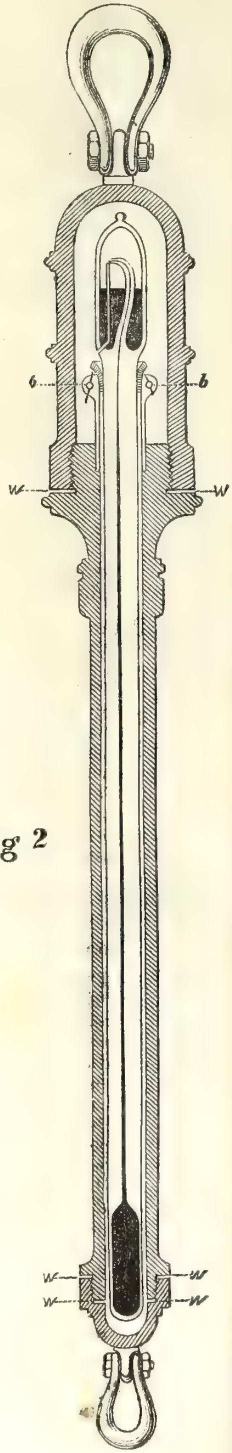


Fig 2



—any rise of temperature will expand the mercury and cause it to overflow in minute globules into the reservoir above. The platinum wire is simply for the purpose of preventing the formation of large drops at the point of the jet, by its superior attraction for the fluid metal. Upon cooling, the mercury now remaining will, of course, sink in the tube. The instrument is so graduated, that if it were cooled to 0 deg. Fahr., the level of the mercury would precisely indicate the highest temperature to which it had been previously exposed; but if the observation were made at the atmospheric temperature, the mercury would stand exactly as much higher in the tube, *i.e.*, lower in the scale—as the temperature of the air was above 0 deg. Fahr.; therefore, to ascertain the maximum temperature, it is only necessary to add to the degree at which the mercury stands, the temperature at the time the observation is made. Thus, supposing the "compensation" thermometer marks 35 deg., and an ordinary instrument by its side is at 50 deg., 85 deg. will be the highest temperature that has occurred since the last observation. To "set" this thermometer, the lower bulb must be gently raised, until the mercury runs down the tube into the reservoir-bulb; when contact has thus been established between the two portions of the metal, the reservoir-bulb is slightly elevated, care being taken to keep the point of the glass jet under the surface of the metal (the dotted line *a. a.* in the diagram, represents the level of the mercury during this operation). The mercury will now flow back into the lower bulb, and refill the small vacuum produced by the previous decantation, when, upon restoring the instrument to its original vertical position, the tube will be full to the extreme point of the jet. It will be at once seen that vibration or agitation cannot militate in any degree against the accuracy of this instrument, no moveable indices being employed. Fig. 1 gives a view of the upper bulb, and a portion of the scale, of the actual dimensions. Fig. 2, one-third full size, shows a section of the entire instrument in a gun-metal tube for deep-sea experiments. The thermometer is "set," and inserted in the tube (into which, after greasing, a little mercury has been poured), oscillation being prevented by rings of vulcanized india-rubber, the upper one clamped by the binding screws *b. b.*; lastly, the cap is tightly screwed on, the arrangement being then ready for use. Well greased leather washers occupy the spaces at *w w.* The silver medal of the Society of Arts has recently been awarded to the inventor for this instrument. It has also been examined and approved by Rear-Admiral R. Fitzroy.

165. Spirit Levels Without Fixed Stands; R. H. Bow, C.E., 7, South Gray-street, Edinburgh.

The principle on which these levels are planned consists in such an arrangement that the observer may note at the same instant the height of the cross hair as projected against the levelling staff, and the momentary central position of the bubble in the spirit-level. The simplest form of the instrument, shown by fig. 1, differs but little in external appearance from the common pocket or workman's spirit-level, and can be put to the same uses in addition to its particular duty of affording observations by being simply held in the hand whilst looking through it. For more accurate observations other forms of the instrument may be constructed, in which a telescope with cross hair may be incorporated with the spirit-level: the most perfect of these is that shown by fig, 2, in which, by means of the very narrow reflector *r*, and the thin slice of a lens L, an image of the bubble is formed near the cross hairs, and consequently seen as though part of the landscape.

Fig. 1.

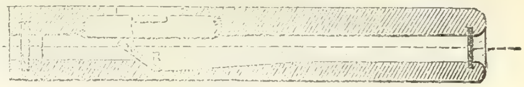
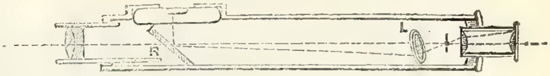


Fig. 2.



166. Dr. Page's Revolving Armature; J. W. Duffey, 13, Meredith-street, Clerkenwell, E.C.

The peculiarity of this invention consists in the use of uncovered wire for the electro-magnet, which is not only cheaper, but is stated by the inventor to allow of the introduction of a greater amount of wire in a small space without depreciation of power.

167. Improved Electric Bell; J. Sandy.

168. Apparatus for Winding Turret Clocks; Alexander Dold, Chatham.

This apparatus consists of a rod passing from the clock or other machinery through a hollow tube to a circular frame, formed by a series of vertical bars (moveable diagonally), and thence to a bearing in a dome above the circular frame. In the centre of the circle formed by the bars, the rod carries certain volants or fliers; from the disposition of the vertical bars the wind, from whatever quarter it may blow, acts upon the volants, which invariably turn in one direction, and the rod, rotating with them, gives motion to the mechanism in which it gears. This apparatus is also applicable as a motor for machinery, and for increasing the draught in chimneys.

169. Tidal Clock; Alexander Dold.

The mechanism or wheel-work only is shown, as there is no means of showing the working of the tidal power. A rod is so arranged when the clock is fixed (say at the mouth of a tidal harbour, or in or near a tidal river) that it will rise or fall with the tide. The upper part of the rod gears into the winder, and so the clock is wound up each tide without manual aid.

170. Patent Improved Watch Case; John Wells, 42, Percival-street, Clerkenwell, E.C.

The improvement consists in an arrangement whereby the open-faced watch can be readily converted into a hunting watch, or *vice versa*.

To convert the hunting-watch into an open-faced watch, remove the false dome or bottom from the face, and snap it on the back of the case, for which purpose a snap is formed thereon to receive it.

171. Improvements in Watches and Clocks; James Young, Knaresborough.

The improvements consist first in the application of a ratchet wheel to the fusee, arbor, pivot, axis or barrel with a click and spring attached to the plate. When the click is brought into action, it instantly arrests the power, and at the same time detaches the main wheel from the rest of the wheelwork, thus enabling the escapement and other wheels to be taken out and repaired, without letting the spring or weights run down. This principle is applicable to all kinds of watches and clocks. Secondly, there is an improved lever. Instead of the safety pin on the surface of the lever, the inventor places in its stead two segments of steel, which meet in the centre of the fork of the lever. When the ruby pin carries the lever back, and leaves the fork, the roller advances into the quadrant, the hollow part of the roller allowing the apex of the segment to pass, and thus, even should the banking pins be out or wanting, the escapement will not set.

172. Compass applied to the Box-Sexant; H. Swaisland, 54, Great Sutton-street, Clerkenwell, E.C.

The following are the directions for using this instrument:—Move the larger milled head to allow the index to be near the centre of the divided plate. Release the card by lifting the little dovetail between the light and compass ring; place the jointed magnifier on an angle over the top of the light; look through the sight hole to the pin at the opposite extremity of the plate to the object required; slightly raise the head, and look through the magnifier to the vernier pin of the compass; when the card is sufficiently steady, the bearing may be obtained.

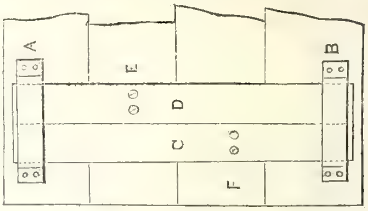
173. Patent Apparatus for Drawing Geometric Curves; Henry Johnson, Crutched Friars, E.C.

The instrument consists of a bar or upright, held in a vertical position against a plane, and furnished with a metal point for a centre. To this bar or upright is attached one end of a horrizontal rod. The upright passes through the horizontal rod, or a small block fixed upon the end of it, so that the horizontal rod may revolve round the upright as a centre. The outer end of the horizontal rod is furnished with a drum or pulley, over which a chain or band passes; one end of this chain or band is fixed to the centre upon a level with the pulley, and the other end of the chain or band, after passing over the pulley or drum, returns and is attached to a slide which carries a pencil or marking instrument. The horizontal rod is caused to revolve round the upright, and the chain or band is thus wound round the upright, each succeeding coil enclosing the preceding one, and the slide is drawn from the centre towards the pulley or drum at the outer end of the horizontal rod, by which a curve is traced by the pencil or marker progressively, increasing as it is drawn from the centre. The centre is furnished with tubes, one or more of which can be pushed down to increase the size of the centre when required. Any modification of the size or shape of the centre, or of the size of the chain will affect the curve described by the pencil. The instrument may be varied by using a boss revolving upon the upright with a slot in it, through which a flat bar passes with teeth on one side gearing into the teeth of the pinion fixed on the upright, so that as the boss revolves the bar which carries a pencil or marker is moved by the pinion; several change pinions may thus be used at different times to produce different curves; or, in place of pinions, a spiral toothed rack, decreasing in diameter from the base upwards, may be used, the toothed rack being kept up to its work by a spring.

174. Patent Apparatus for taking Accurate Views; T. Edmund Anscombe, 95, Westbourne-street, Pimlico, S.W.

This apparatus consists of a perpendicular wooden frame, and a parallel frame, with two points working up and down; a perpendicular rod, the upper point tracing the objects, while the corresponding point, holding the pencil below, transfers the object to the canvas fixed on the frame; the tracing point works upon the imaginary plane fixed in the frame; the point of sight being fixed by three rods, moving to or from the imaginary plane, to give the required scale of drawing.

175. Howlett's Drawing Board; James Newman, 23, Soho-square, W.



The ends of the clamps of this drawing board are passed through iron straps, screwed to the outer edges of the board. By this arrangement the board is held firmly to the clamps, and is stated to be free to shrink or expand, without splitting or warping.

176. Lay Figure for the Use of Artists, in Wicker-work; G. W. Scott, 43, Old Compton-street, Soho, W.

The advantages of these figures are that, being composed chiefly of wicker-work, they are extremely light, and can be easily moved about, and they are also much less in cost than the ordinary lay-figure. The joints are so arranged that they can be tightened when required.

177. Art Decoration on Mirrors; E. Agneni, 29, Devonshire-street, Queen-square, W.C.

This painting is on the back of the glass, and is thus protected from injury and decomposition.

178. Patent Reservoir Penholder; J. Ridsdale, Stoke Newington-green, N.

The reservoir is formed of vulcanized india-rubber.

179. Patent Fountain Pen; Moseley and Son, 17 and 18, New-street, Covent-garden, W.C.

180. Solid Marking Ink Pencils, for Writing permanently on Linen and other Fabrics; Arthur and Richard Dunn, 1, Dalston-terrace East, N.E.

These pencils consist of marking ink in a solid, instead of fluid form. The linen is damped before being written upon. These pencils may be used for a variety of purposes where a permanent mark is desirable, as labels for florists, &c., their exposure to light rendering the writing indelible.

181. Derogy's Patent Photographic Objective; Lloyd Chapman and Co., 196, Strand, W.C.

The objective consists, like the present portrait lenses, of two compound achromatics. When a longer or shorter focus is required, a small extra lens is placed in the middle of the tube. When used for views or reproductions, the front part of the objective with the sun shade and lens, is placed in the back end of the tube in the Camera, after having removed the lens previously there. The cap is made to be placed either upon the sun shade, or tube, when operating for Views; the focus is then lengthened or shortened, as above stated; but when a long focus is desired, the front part of the objective is replaced, as if for portraits. The diaphragms are fixed in the same place as the small extra lenses.

182. Drawing-Room Stereoscope; A. W. Bennett, 5, Bishopsgate-street Without, E.C.

183. Specimens of Non-Inverted Coloured Positives on Glass; James Newman, 24, Soho-square, W.

These non-inverted coloured positives are coloured with Newman's photographic colouring, and varnished with penetrating varnish.

184. Specimens of Machine-cut Medal Punches; C. J. Hill, Frolich Cottage, Turnham Green, W.

The machinery employed for these specimens, is stated to produce medal work surpassing in accuracy and minuteness that produced by hand. One model will suffice for the production of an unlimited number of punches varying in size, from as large as may be required to one five or six hundredth of the size of the model. If this process were used, the most rich and elaborate designs could be adopted for coins, which could be distinctly modelled on a large surface, and given without any appreciable loss in the smallest reductions, and coin struck from dies pressed from such punches would retain the proof of its genuineness till the last, by reason of the perpendicularity of the work on its surface. It is applicable for cutting hall-marking punches. A piece of work usually consumes about one-seventh of the time ordinarily required for its production by hand.

185. Geometrical Scale for Simplifying Arithmetical Calculations; J. Reed, 22, Tabernacle-row, E.C.

By means of these scales the various operations of addition, subtraction, multiplication, division, and the extraction of the square and cube roots may be easily worked. If one of the properties of a circle is known, the other remaining properties may be ascertained.

186. Patent New Compass Rule; Buss and Adkins, 21, Poultry, E.C.

This instrument is an improvement on the ordinary parallel rule, and is intended for immediately determining the bearings of two places on a chart, or for setting a ship's course, without reference to a compass on the chart, or moving the rule from its first position. Its edges are graduated, and the rule is so contrived that it revolves round a centre to which is attached a disc marked with the points of the mariner's compass; thus by the aid of a line on the upper surface, which is at once parallel with the edges of the rule, and runs through the centre of the compass disc, the ship's course or the bearings between two places may be instantly obtained. When used, it is necessary to set the cardinal points marked on the disc so that they coincide with the lines on the surface of the rule, and in such a manner that when the edge of the rule is placed on a parallel (or meridian) the N point of the disc shall be directed to the north of the chart. The finger is then pressed on its centre, to retain it in position, the rule is turned on its axis, and the edge is brought over the two places; the bearing or course can then be read from the compass disc, where it coincides with the line parallel to the edge of the rule.

187. Tangible Arithmetic for the Blind; contrived by the Rev. William Taylor, F.R.S. Abraham Pope, 80, Edgeware-road, W.

The contrivance consists of a sort of board of gutta percha, half an inch thick, and of any convenient size, the smallest being three inches and a half wide, and seven long. It contains 128 octagonal holes, into which square pegs are to be placed to represent numbers, &c. At one end there are two small projections, about one tenth of an inch high; at the other end one projection continues the whole width of the peg. These serve to show which end of the peg is uppermost, and its position in the hole. Between the holes there are saw-cuts (one-eighth of an inch deep) across the board, dividing it into as many squares. Into these saw-cuts small strips of tin are inserted, to serve as *lines* or *vincula*. They are of various lengths, and some of them have a notch near the end, on one side, and two notches on the other, and some are plain. When these tins are placed over one or more algebraical quantities, with the single notch to the left-

Fig. 1.

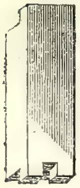


Fig. 2.

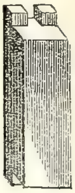


Fig. 3.

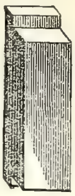


Fig. 4.

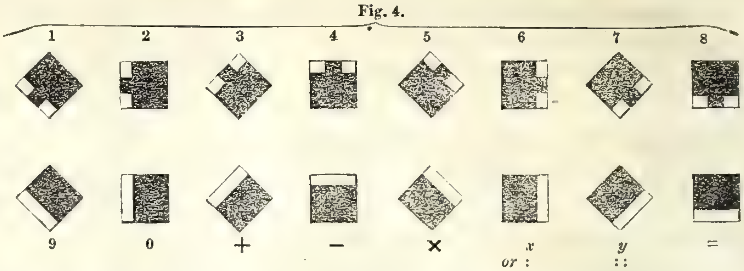
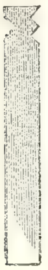


Fig. 5.



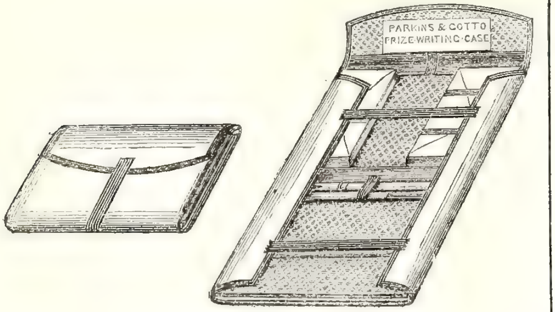
hand, it represents the *square root* of those quantities, and when the notch is to the right-hand, the *square* of them. The *cube* and its *root* are simply indicated by the *double notch*. Other tins with different notches may serve for other powers and roots. The plain or unnotched tins serve to separate fractions, &c., and for lines in common arithmetic between sums and their answers. By these means, blind persons are enabled to solve questions in arithmetic and algebra. (See *Journal of the Society of Arts*, Vol. VII., p. 328.)

188. Specimens of Geographical Modelling and Maps in relief in Papier Maché Plaster; John Brion, 7, Devonshire-street, Hammersmith, W.

These maps illustrate the application of hydraulic machinery to register printing and embossing.

189. Portable Museum of Natural Substances. Exhibited by the Collector, Thomas E. Dexter, Royal Military Asylum, Chelsea. S.W.

190. Society of Arts Prize Writing Case; Parkins and Gotto, Oxford-street, W.



The prize of twenty pounds (placed at the disposal of the Council of the Society of Arts by the Rev. F. Trench and J. MacGregor, Esq.,) and the Society's silver medal, offered for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., have recently been awarded to Messrs. Parkins and Gotto, for the case exhibited. The conditions of the competition were as follows:—

1. *Weight.*—None will be received weighing above five ounces when empty.
2. *Size.*—The size in length and breadth must not exceed that necessary to hold note paper.
3. *Ink.*—The case must not contain ink in a fluid state.
4. *Durability.*—It must be made of a substance not liable to be spoiled by wet, and which will protect the contents from injury.
5. *Cheapness.*—The retail price, with guaranteed supply, must not exceed 1s. 6d.

The case exhibited is made of a waterproof material, and, when closed, is of the ordinary note-paper size. The edges of the case fold over throughout its entire length, and are retained in their position by elastic bands, similar bands being also employed for holding the envelopes, pens, &c., in their position. The case contains a blotting-book, note paper, envelopes, an indelible pencil, four pens, and a pen holder. The retail price of the case will be 1s. 6d., and the additional cost of the contents as arranged will not exceed sixpence.

191. Apparatus for the Painless Application of Cold, Electricity, and Heat as Remedial Agents, and for producing Local *Anæsthesia*; J. D. Morrison, 3, South Charlotte street, Edinburgh.

This apparatus consists of a metal cistern, which, while it admits of a current of hot or cold water being constantly circulated through it, takes advantage of the metal as a conductor of heat and electricity, so that either or both may be supplied to or abstracted from any desired part of the body for the purpose of local anæsthesia, and for avoiding hæmorrhage in operations. In an amputation of a finger, arm, or leg, all that is necessary to render the part to be operated upon insensible is simply a hollow ring, with supply and waste pipes attached to flexible tubes in connection with ice. These rings may be divided or subdivided so as to answer any operation, or to serve as a guide for the operating instruments, while describing the proper curves or lines in circular or flap operations. When used for dental surgery, metallic chambers, accurately fitting the jaw, are employed, which, by enabling a current of iced cold water to pass through them, produce speedily and certainly a state of anœsthesia.

192. Improved Lever Forceps for the Extraction of Teeth; James Joseph Cregeen, M.D., F.R.C.P., Plough-road, Rotherhithe, S.E.

This invention consists in placing the beak of the forceps to one side, so that the operator sees its proper adjustment to the tooth, at the same time much increasing the leverage power. In the construction of the different forceps, the handles may be so flexed as to cause their application to any tooth a comparatively easy matter.

193. Military Tourniquet; T. P. Salt, 21, Bull-street, Birmingham.

194. Sphygmoscopes, Cardiac and Arterial, for Indicating the Pulsations of the Heart and Arteries; Dr. Scott Alison, 80, Park-street, Grosvenor-square, W.

These instruments are intended to indicate the extent of the pulsations. When provided with flexible tubes, the glass pipes partially filled with coloured water may be brought into juxtaposition, and great facility is thus obtained for learning the relative commencement of different pulsations in different parts of the body. (See Proceedings of the Royal Society for 1856.)

195. Differential Double Stethoscope or Stethophone; Dr. Scott Alison.

This instrument is provided with two apertures for collecting different sounds at two different parts of the body at the same time, and conveying them separately to the ears. It affords an absolute test of differences of intensity of the same sound at two different parts, for a sensation is obtained in that ear only connected with the part at which the intensity is greatest. It serves sensorially to restrict sounds to the place of their greatest intensity, and is useful in dealing with murmurs of the heart. It affords a means of ascertaining the comparative power of different bodies, solid, liquid, and gaseous, as well as of different acoustic arrangements to propagate sound to an enclosed column of air. It also serves sensorially to divide sounds. (Vide Proceedings of the Royal Society, 1858, and Proceedings of the Royal Institution, 1859.)

196. The Stethogoniometer, or Chest Goniometer; Dr. Scott Alison.

This is an instrument for measuring the angles of the chest and the angles of tangents to curves. It takes cognizance of the configuration of the chest and the inclination of one plane to another in disease. (Vide the Archives of Medicine, 1858.)

197. The Hydrophone; Dr. Scott Alison.

This is an instrument for increasing the amount of sound obtained from solid bodies. It is placed at the further extremity of a hearing tube, between its aperture and the solid body. The hydrophone increases the amount of sound from solids in the case also of the naked ear—the natural hearing tube. It consists simply of a thin vulcanised india-rubber bag, partially filled with water, and has much the size and shape of a moderate sized watch. By fitting well upon the apertures of hearing tubes including the ear, the hydrophone increases the amount of sound which reaches the internal ear, for it closes the opening and confines sound like the microphone of Wheatstone. (Vide Proceedings of the Royal Society, and Proceedings of the Royal Institution, both for 1859.)

198. Kaleidoscopic Colour-top; John Graham, Tunbridge.

This invention is designed to show that when white or coloured light is transmitted to the eye through small openings cut into patterns or devices, and when such openings are made to pass before the eye in rapid successive jerks, both form and colour are retained upon the nerve of the visual organ sufficiently long to produce a compound pattern, all the parts of which appear simultaneously, although presented in succession. The instrument forms, therefore, a pleasing illustration of the law that the eye requires an almost inappreciably short space of time to receive an impression, and that such impression is not directly effaced, but remains for an assignable though very limited period. The results are obtained by rotating two discs on a wheel, the lower disc containing the colours, and the upper one the openings; this latter disc is made to vibrate as well as to rotate, thus allowing the eye to receive the coloured light reflected from below, which light assumes, at the same time, the forms of the patterns through which it has been transmitted. The instrument serves also to illustrate most of the important phenomena of colour. (See *Quarterly Journal of Microscopical Science*, January, 1859.)

199. Table-tops, Mother of Pearl, Inlaid with Metal by Electrotyping; Otto von Corvin, 50, Upper Bedford-place, Russell-square, W.C.

Ornaments are first cut out by hand or machine, after a given design, from thin plates of pearl, tortoise-shell, ivory, wood, metal, or any other suitable material. One side of these ornaments must be perfectly flat. The flat side is fastened, according to the design, on some metallic surface, for instance, a copper-plate, by means of varnish. This plate, together with the ornaments, is then submitted to the electro deposit. The metal deposited on the whole plate, on which are fastened the ornaments, surrounds and covers them. After the deposit has acquired the desired thickness it is severed, by a slight force, from the original plate, on which the ornaments were slightly fastened by varnish. This varnish gives way easily, and by turning the deposit on the right side, all the ornaments will be found perfectly inlaid in metal. This surface may now be engraved, gilt, &c., or further ornamented in any desirable manner.

AGRICULTURAL IMPLEMENTS, MACHINERY, &c.

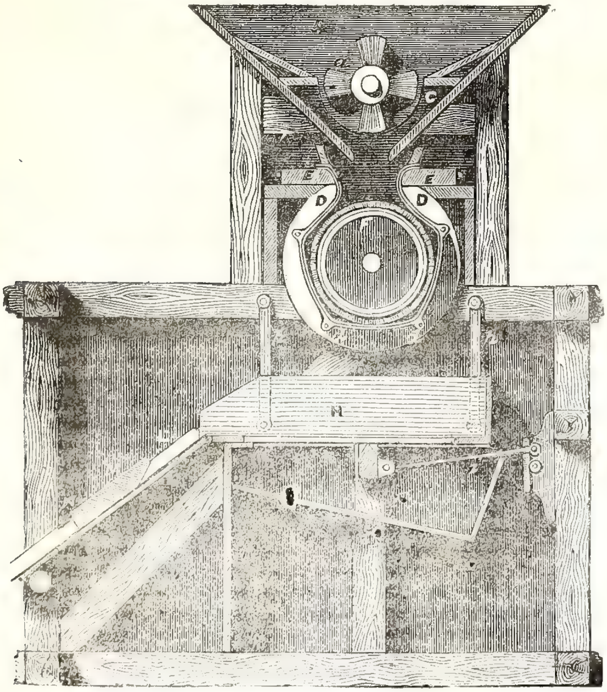
(For the remainder of the Articles in this Section, see Drawings.)

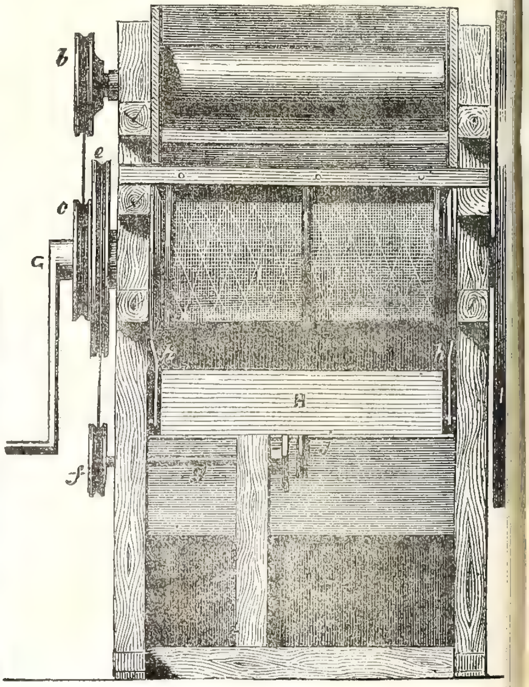
210. Collinson Hall's Patent Windlass and Steam Plough and Implement Gear; J. Fowler, Jun., 28, Cornhill, E.C.

The object of this mechanism is to render effective the whole power of engines used in drawing ploughs or other implements in tilling land. This is accomplished by carrying the wire rope in the form of the figure 8 round horizontal drums fixed (so as to be easily removeable) under the engines. By this arrangement the evils arising from overlaying the coils of rope when wound upon the capstan principle are avoided, as also are those arising from an unequal wear of the ordinary horizontal pulleys. In the new arrangement the solid drum is constructed with several grooves, while the other is composed of as many independent pulleys as there are grooves in the drum. The upper or lower pulley, as the case may be, revolves in one direction, while the remaining ones revolve in the opposite direction. The solid drum only is driven directly by the engine, while the pulleys revolve by frictional contact, and thus all slipping is avoided. In this gear, little or no framing is required. The axes being bolted to the bottom of the boiler, a rod or beam retains them in a vertical position. The gear may be fitted and again unshipped from an engine (by means of keys through the axes, by which the gear is retained in place) in less than ten minutes.

211. Patent Carrot Seed Bearding and Dressing Machine; J. Scott, 111, Drummond-street, Euston-square, N.W.

This machine removes the hirsute covering from carrot seed without, as is stated, in the slightest degree injuriously affecting it; but on the contrary, it is asserted that the vegetative properties of seed so dressed are improved from twenty-five to thirty per cent. The operation is effected by the use of cylinders or cones, covered with wire card metallic brushes, perforated metal, or other suitable rough surface enclosed in wire gauze casing, and capable of being regulated to suit the description of seed required to be operated on. By a slight modification it may be adapted for milling clover or trefoil, and other such like purposes.





212. Patent Britannia Self-raking Reaping Machine; B. Samuelson, Banbury, and 76, Cannon-street West, E.C.

This machine is made to cut 5 or 6 feet in width, and is drawn by two horses in advance of the near side. The action of the knife is reciprocating, the same as McCormick's, Hussey's, &c. The peculiarity in this machine is the self-acting apparatus for raking the sheaf off the platform; this is effected by means of very simple mechanism, communicating from the driving wheel to a rake-head fitted on a crank. As the cut corn falls upon the platform the rake descends upon it near the knife, sweeps it with a circular movement to the rear of the near side of the machine, and drops it in a clean bundle ready for the binder; the rake then ascends, by a turn of the crank, and traverses towards the knife again for the next sheaf. It leaves a clear space for the horses to come the next bout. The rake is completely under the control of the driver, who, by placing his foot on a lever, can suspend its action, to make large or small sheaves, or to suit the crop. The travelling wheels are large in diameter, and strongly constructed, enabling the machine to cross water courses, or run on rough bye-roads with facility and without danger of breakage. It is stated that a boy old enough to drive a pair of horses can manage it, and do from 12 to 15 acres a-day.

213. Gardner's Turnip Cutter, with apparatus enabling various sizes to be cut with the same knives; B. Samuelson.

This is an improvement on the well-known double-action turnip cutter. It has thirty cranked knives projecting from the surface of a hollow cylinder facing in one direction, and two slicing knives extending from end to end of the cylinder facing the other way, so that small pieces for sheep, or slices the whole width of the root, may be cut according to the direction in which the cylinder is turned. The patented improvement consists in using plates of various thicknesses and shapes; these are bolted to the space in front of the knives, and, in some cases, upright knives are used to subdivide in width. The plates are easily fitted to or detached by the most ordinary labourer. The object of the invention is to enable the same machine, besides its usual purpose of cutting finger pieces for sheep and slices for cattle, also to cut thin slices for young calves and very small strips for lambs, or for mixing with straw, chaff, meal, bran, &c., for cattle.

214. Patent Fumigator and Mildew Annihilator; E. Spary, Queen's Graperies, Brighton.

Figs. 1 and 2 represent the elevation and section of the larger apparatus, to be heated by charcoal or coke, wherein the top of the receiver is sealed down, and a pipe fixed on the top to convey away the fumes through a flexible hose to the spot required; or, where pressure is necessary to drive the fumes through a long pipe, an hydraulic holder is added, with tank, pulleys, and weights. Into this the fumes are collected, and forced through the pipes by the regulating weights placed on the top. The larger apparatus is generally used outside the building.

Fig. 1.

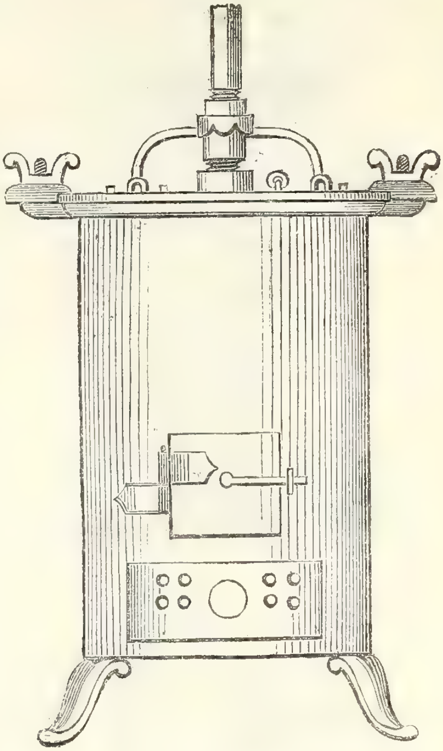
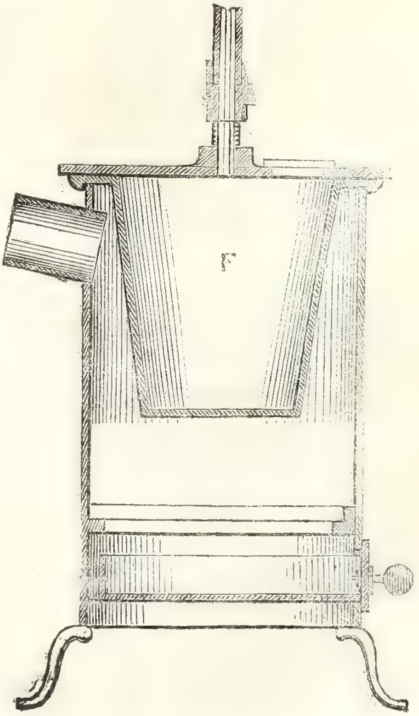


Fig. 2.



215. Patent Fumigator and Mildew Annihilator; E. Spary.

Figs. 3 and 4 represent the elevation and section of a small apparatus for fumigating grape vines, fruit trees, and plants for the purpose of destroying the mildew and insects; also for fumigating all kinds of horticultural buildings, hospitals, barracks, ships, sick rooms, and vapour baths. The apparatus consists of a receiver, F, dropped into an outer cylinder, and supported by a flange projecting round the middle. A perforated cover is fixed on the top, and a lamp, L, is placced underneath. The fumigating materials are put into the receiver, and when heated are rapidly disseminated.

Fig. 3.

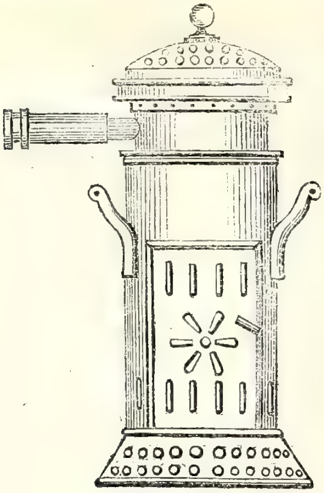
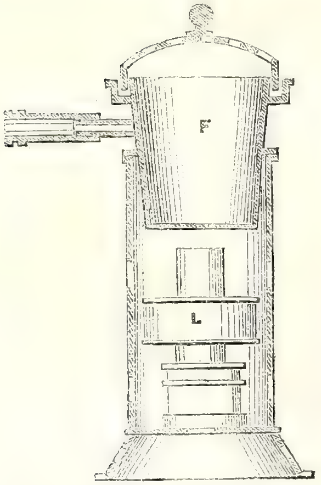


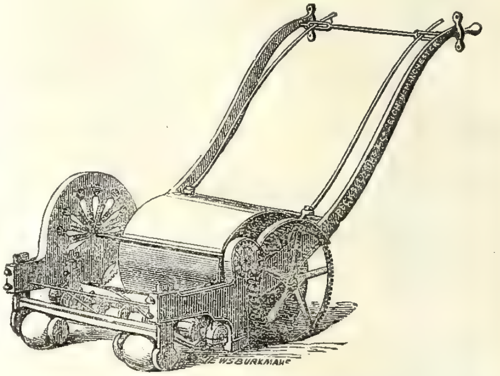
Fig. 4.



216. Patent Instruments for Gathering Fruit and Flowers; T. M. Jones, 3, Church-row, Homerton, N.E.

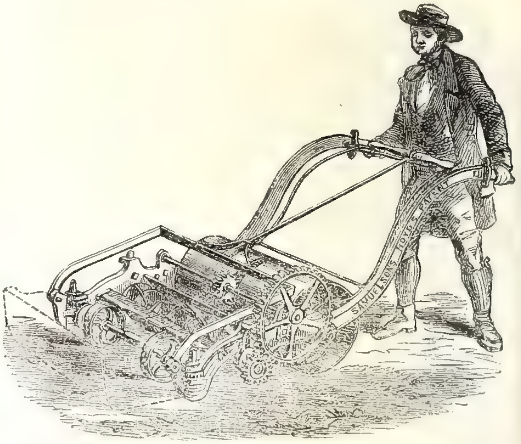
In these instruments two plans are adopted, one for cutting the fruit, by a pair of blades, worked by a sliding wire, acted upon by the finger at the lower end of a long rod, and receiving the fruit in a net; and the other for gathering it by holding it firmly, but without injurious pressure, between two discs of vulcanised india-rubber, mounted in frames worked in a similar manner.

217. Patent Lawn Mower; Picksley, Sims, and Co., Leigh, near Manchester.



In this mower the wheels are encased, so that no grass or branches of shrubs can come in contact with them. It will mow on undulated ground or hill sides, and can be either drawn or pushed. It runs on balls in front of the machine, working against friction-balls inside of cups, which enables it to turn right and left, or in any other direction. The cutters are raised and lowered by a rack and pinion motion, so as to cut any length of grass.

218. Boyd's Patent Lawn Mowing and Rolling Machine; B. Samuelson, Banbury, and 76, Cannon-street West, E.C.



The improvements consist in adapting a brush which is so placed that the edges of the knives come in contact with it as they revolve, and are thereby kept clean, so as to enable them to cut the grass wet or dry. The arrangement for raising and lowering is regulated instantaneously, and without a possibility of lowering or raising one side more than the other. The machine rolls at the same time the whole width of the grass cut.

219. Permanent Observatory Bee Hive; W. B. Tegetmeier, Muswell-hill, N.

This is a bar and slide hive, having each side formed of four parallel plates of glass, with spaces of air between. This construction is stated to render the hives so perfectly non-conducting that the warmth of the bees is retained even in winter, and the hives do not require to be covered over with any opaque material; hence the actions of the bees are always open to observation, without their being disturbed by the sudden and unexpected admission of light.

220. Patent Garden Engine, also applicable to Fire or other Engines; Thos. G. Messenger, Loughborough.

This invention consists in placing two brass cylinders horizontally, in which two pistons work by one piston-rod; between the cylinders is placed a valve-box, containing four valves, one for each cylinder, opening inwards, and one outwards into an air chamber, from which a tube is carried to the top of the tub in which the engine is fixed, and mounted with a brass branch pipe with universal joints and a double spreader, so as to answer the purpose of either jet or rose. The engine is worked with a long lever. To prevent the water passing from one cylinder to the other, a stuffing-box is placed in the valve-box through which the piston-rod works.

221. Green's Improved Box for Floriculture; J. Collins and Co., Lett's-wharf, Waterloo-bridge, S.

This box allows free access of air and of nutriment to the root of the plant. Water or liquid is supplied through a tube, and the fibres of the roots take up what they require, and the surplus of moisture is then drawn off at the other end of the frame, in place of being allowed to remain and rot the lower fibres of the plants. The box being perforated, free circulation of air about the roots is permitted.

222. Patent Garden Syringe; W. Palmer, 156, Western-road, Brighton.

In this syringe there is a finely-perforated strainer placed within a case, having a stop valve in connection with it.

223. Glenny Watering Pot; Loveridge and Shoolbred, Wolverhampton.

From the peculiar construction of the handle of this watering pot, the weight is more easily balanced in the hands.

224. Patent Horse and Cattle Fastening; G. W. Baker, Park-farm, Woburn.

The object of this invention is to facilitate the release of cattle in case of fire. By its means, a single person, without even entering the building, has the power of releasing a whole shed of animals at one and the same time. Fig. 1 is a view of the Cattle Fastening as fixed when a beast is attached. Fig. 2 is a view of the same opened, as when the animals are released. This is done by means of a lever at the end of the building outside, which, when pulled, opens all the fastenings simultaneously, being connected with each one continuously by ordinary iron gas piping of $\frac{3}{4}$-in. diameter. The animals are thus released with their ties on, which is a great advantage, as they can then be led away to any convenient place and tied up, instead of being turned loose into the country. The fastenings intended for horses are made shorter.

Fig. 1.

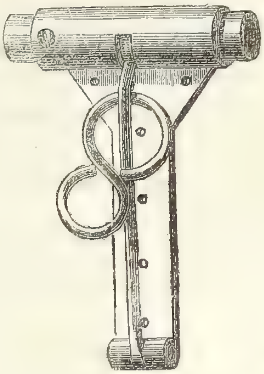
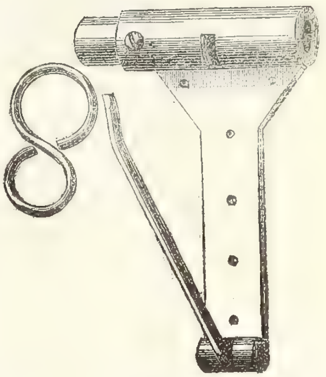


Fig. 2.



225. Patent Fish Manure; Samuel Osler, 12, Brighton-terrace, Great Yarmouth.

In the preparation of this manure, fish is subjected to a prolonged heat of about the temperature of boiling water, the watery portion separating from the fibre with the gelatine and oil; the whole substance of the fish being resolved into three parts, the fibre and bone, which remain in a comminuted solid, constituting the manure, and containing the ammoniacal constituents of phosphates; the gelatine being dissolved in the water, and the oil floating on the surface. This is skimmed off; and the water, with the gelatine in solution, is separated, and the fibre that remains is dried for manure. The water, with the gelatine of the fish, may be evaporated for fish glue, or inferior isinglass; otherwise it may be used for liquid manure.

BUILDING, SANITARY, AND DOMESTIC APPLIANCES.

(*For the remainder of the Articles in this Section, see Drawings.*)

236. Patent Dry Gas Meter; N. Defries, 5, Fitzroy-square, W.

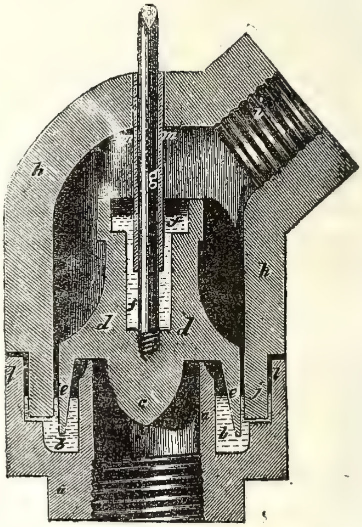
This meter has a rotary valve, with leather cover, by which means security from leakage as well as perfect registration are stated to be secured.

237. Patent Wet Gas Meter; N. Defries.

In this meter, in order to keep up the water to a constant level, there is a vessel containing an additional supply of water affixed to the meter, from which there is a descending pipe with a covering valve, similar to an oil vessel of a lamp, to facilitate the filling and refixing of the water supply vessel to the gas meter, this valve being open when the vessel is fixed to the meter and the meter is in use. The pipe of the water supply vessel descends into a water chamber in connection with the meter in such manner that the water in the meter and the water in the chamber will at all times stand at a like level. In the event of the water in the meter and in the water chamber connected therewith evaporating or otherwise falling below the proper level, water will be allowed to descend from the vessel containing the additional supply by reason of provision being made for the passage of air from the outer atmosphere into such water vessel when the meter falls too low, but the flow of air from the atmosphere into the additional water supply vessel is shut off as soon as the proper water level is obtained in the meter.

238. Patent Safety Gas Valve; J. T. Willway, 29, St. Augustine's-parade, Bristol.

This valve is designed to facilitate the turning off and on of the gas in private houses, shops, &c. The ordinary main tap, owing to its position, is frequently so difficult to get at, that the gas is in many cases allowed to remain constantly in the pipes. With this apparatus the gas may with the greatest ease be turned off or on at any part of the building. The valve is represented in section in the accompanying woodcut. *a*, is a neck or collar into which the mouth of the gas supply tube screws, and which rises inside so as to form a cup, *b*, in which is placed mercury, or a ring of india-rubber. The collar, *a*, receives the cone, *c*, forming part of the valve, *d*, which has also formed on it the ring, *e*. This ring, by entering the mercury, or descending tightly against the india-rubber, forms a sealed joint. *f*, is a second cup, for containing mercury, and *g*, is a rod rising from it. *h*, is the cover in which is the aperture, *i*, for the passage out of gas to the burners or elsewhere. The bottom part, *j*, of this cover enters the mercury in the cup, *b*, while at the joint it rests upon the upper rim, *l*, and the parts are held together by screws through lugs at the side. From the top of the cover, *h*, descends the pipe, *w*, through which the rod, *j*, passes, and which dips into the mercury in the cup, *f*, to prevent the escape of the gas. By raising and lowering the valve, *d*, by means of the rod, *g* (which may be conveniently done from a distance by attaching it to a peculiar pneumatic apparatus, similar to that used for the atmospheric bell), the supply of gas through the outlet, *i*, can be shut off, fully opened, or regulated at will. (See *Mechanics' Magazine*, April 10th, 1858.)

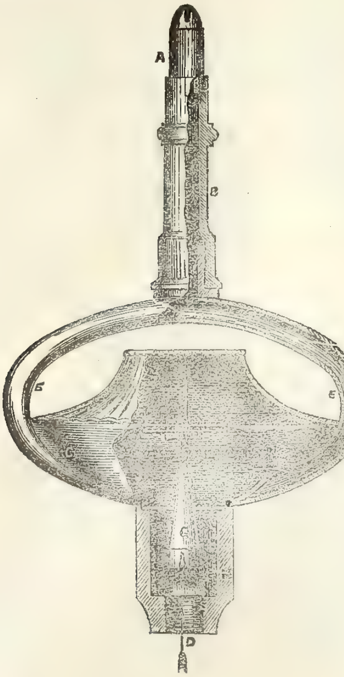


239. Clibran's Patent Gas Governor for Street Lamps; Charles Esplin, 20, Saville-place, Lambeth, S.

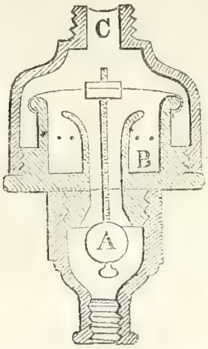
This invention consists of a small gas holder, sealed by mercury, and so arranged as to regulate the pressure.

240. Patent Street Lamp Regulator; J. B. Paddon, Gray's-inn-road, W.C.

In this regulator the gas immediately acts upon a diaphragm, which has a conical valve attached to its centre, and as the pressure is high or low, this valve contracts or enlarges the aperture through which the gas passes. By the application of a magnet to the bottom of the valve working in a soft iron case a graduated force without friction is obtained, which compensates and controls the otherwise irregular action of the diaphragm, and secures a uniform supply of gas to the burner, whatever may be the variation of the inlet pressure. (See *Mechanics' Magazine*, Nov. 13, 1858.)



241. Geyelin's Patent Gas Burner Regulator; Joseph Boulton, 28, Bagnigge Wells-road, W.C.



In this regulator a diaphragm of flexible material is placed below the burner. This diaphragm is weighted so as to modify the pressure of gas, as required.

242. Patent Economising Gas Burner; H. W. Hart, 69, Fleet-street, E.C.

Between the burner and the supply pipe a conical chamber is formed, containing a woollen wad, between two perforated plates of metal. The gas, in its passage from the supply pipe to the burner, expends its force upon the wad, and passes slowly through the wool, giving a steady supply to the burner.

243. Mediæval Gas Standard; Hart and Son, Wych-street, Strand, W.C.

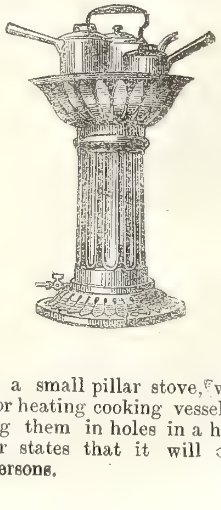
244. Patent Chandeliers; John B. Smith, 2, Grosvenor-place, Lodge-road, Birmingham.

The object of this chandelier is to do away with the hitherto ordinary method of raising and lowering by means of the hydraulic tube and balance weights; instead of which is used a quick-travelling internal screw, by means of which the chandelier can be raised or lowered as required. The advantages of the invention are that it prevents accidents arising from the breaking of the chains to which the weights are attached; and it dispenses with the necessity for using water to prevent the escape of gas, as, when once fixed, it requires no further attention, being perfectly air-tight. It can also be advantageously adapted to glass chandeliers, which have hitherto not been capable of being raised or lowered. This is shown in one of the specimens. The glass chandelier exhibited revolves from the centre; the metal chandelier is worked by means of the handle at the bottom attached to the screw.

245. Patent Light and Heat Generator, or Economical Gas Stove; Syson Nibbs, Birmingham.

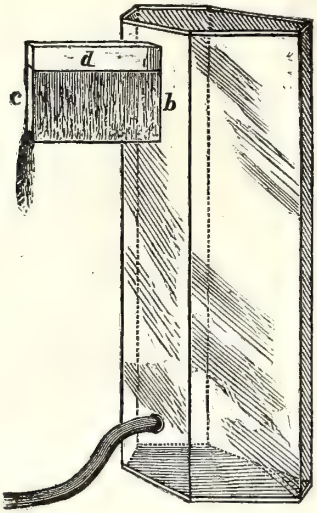
The object of this invention is to economise the amount of gas usually employed in heating a gas stove, and render it available for light. The arrangement of the gas burners is such as to give a good light, which is refracted through a thick globe of glass, and the upper portion of the apparatus encourages a great amount of heat, which is radiated from a polished surface. The top can be removed to admit of its use as a cooking apparatus. A small room may be warmed by the simple application of a lamp where gas cannot be had.

246. Gas Cooking Stove; F. A. Kukla, 194 Pentonville-road. N.



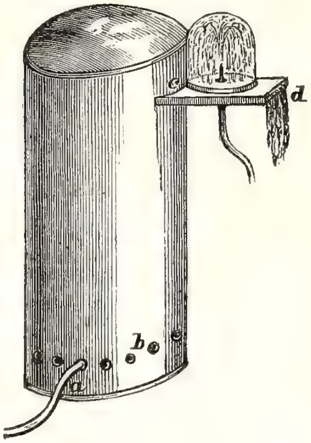
This is a small pillar stove, with an arrangement for heating cooking vessels at the top by inserting them in holes in a hob plate. The inventor states that it will cook for six or eight persons.

247. Gas Stove for Warming and Lighting, with Apparatus for Purifying the Air of an Apartment ; J. White, Finchley, N.



This apparatus consists of a glass case, in which gas is burnt, to which air is admitted from the apartment, and also, by means of an aperture, connected by a tube with the external air. The air passes upwards through the stove, and through the channel *b, c.* ; being purified in its passage by water percolating from the vessel *d.*

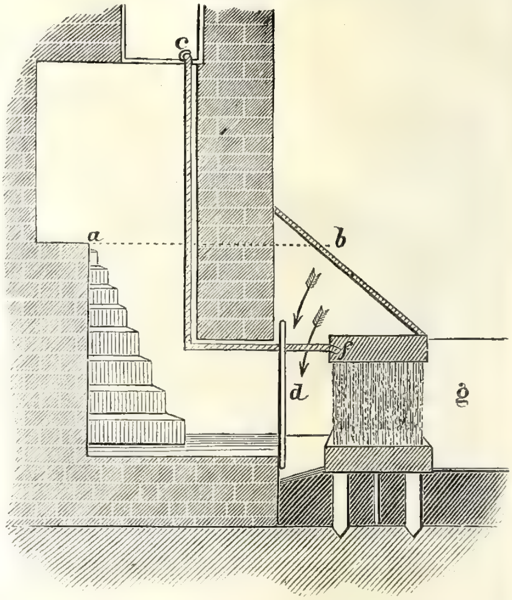
248. Stove, with Apparatus for Purifying Air ; J. White.



This consists of a stove, with or without a flue, enclosed in an iron case, with which it is not in contact. The air of the room is admitted to the outer case and to the stove by the apertures *b* ; and the external air admitted to it by a tube communicating with the case at *d.* The air in the case (mixed with the products of combustion when there is no flue) passes upwards through the channel *c d,* where it is purified by the water of the fountain.

249. Apparatus for the Purification of Air in Large Buildings ; J. White.

The model shows the purifying apparatus now in use at the church of the Holy Trinity, Finchley, Middlesex. *a b* represents the level of the church floor. The heating apparatus of the church is situated to the right of *g*, in a channel along which all the air passes before entering the church ; and the purifying apparatus is situated at the entrance of this channel. The purifying apparatus consists of a tank of water *c*, connected by a pipe, *c f,* to a vessel *f*, having a perforated bottom, through which water falls. If it is desirable that the external air be excluded, the aperture *d* is closed, when the vitiated air of the church, passing downwards through an aperture *b*, is purified on its road to *g*, by the stream descending from *f*. If the apperture *b* be closed and *d* opened, then the external air is admitted and purified in its passage to the heating apparatus *g*.



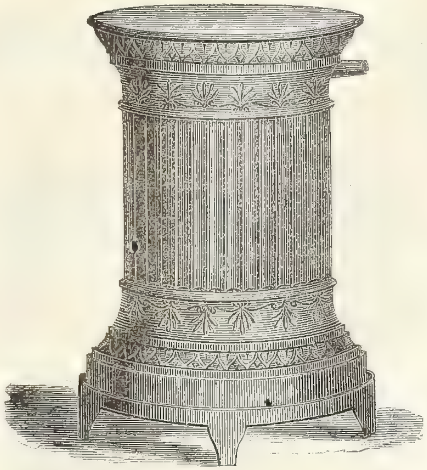
250. Apparatus for the Purification of Air in Chimneys ; J. White.

This apparatus consists of metal plates, with a supply of water falling on the upper plate, and from the upper successively to all the plates to the lower, from which it is conveyed by a pipe. It is placed in the lower part of the chimney ; and the plates are so arranged that the air, mixed with the smoke and products of combustion, in its ascent passes through the waterfalls, and is by that means purified. Or the apparatus may be placed at the top of a chimney, outside the house, when a supply of water is provided for that height.

251. Patent Hygeian Stove ; J. E. Ryffell, Wimbledon, Surrey, S.W.

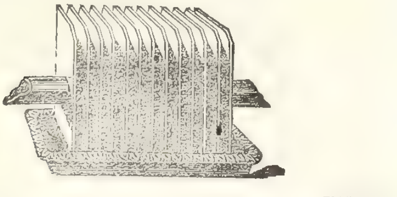
This stove is of cylindrical form, 34 inches high, and 12 inches in diameter. It consists of an outer and an inner cylinder; at the top is a baking tin, resting with its foot on the lid of the inner cylinder. The outer cylinder is hermetically closed at the top by a sand-groove, and there is a rod by which the admission of the outer air into the outer cylinder is regulated; the inner cylinder contains the fuel. It is stated that this stove will burn about twenty-four hours at a cost of one penny, and when lighted requires no further attention. It can also be used as a baking oven.

252. Patent Earthenware Stove; John Roberts, Terra Cotta Works, Upnor, near Rochester.



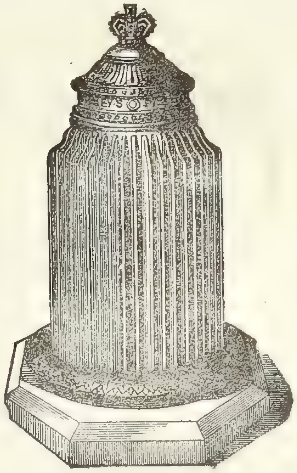
This stove may be made either of fire-clay, iron, or earthenware lined with iron. The fuel burnt in it is stated to be smokeless, and will give a continuous heat for 20 hours or more without any attention. The atmosphere heated is perfectly healthy, sweet, and safe to sleep in. The thermometer seldom varies more than two or three degrees during 24 hours. They are well adapted for nurseries, conservatories, &c. One peculiarity of the fuel is, that it retains its shape after combustion, and, with the addition of another chemical, forms guano. The cost of the fuel is 1s. 6d. per bushel, and the residue of the combustion is valued at 6d. per bushel.

253. Gurney's Patent Improved Hot-Water Pipe; London Warming and Ventilating Company.



This apparatus consists of a steam or hot water pipe, made with a series of transverse wings on flanches in one solid casting, so as to secure a rapid transmission of heat to the extreme edge of each wing.

254. Gurney's Patent Stove; London Warming and Ventilating Company, Limited, 36, Great George-street, Westminster, S.W.



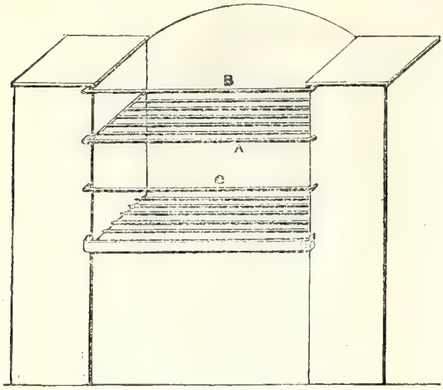
This stove consists of a plain interior cylinder, with a series of perpendicular radiating wings. The stove is placed in a pan of water, regulated to produce the required amount of evaporation. The vapour passes, in conjunction with an ascending column of air, over the external surface of the stove, rising up between the wings, and by this means prevents the stove from being overheated, the air from being "burnt" or overdried, and, under the laws of convection, is stated to cause a rapid intermixture, even when the stove is placed at the extreme end of an oblong room.

255. Patent Smokeless Grate; William Young, 33 and 34, Queen-street, Cheapside, E.C.

In this invention the coals are introduced at the bottom of the fire, under the ignited embers, so that the whole of the gases given off are burned. The apparatus by which the coals are introduced into the fire consists of an iron tray fixed to the lower portion of the front of the stove. Along this, is a right and left-handed Archimedean screw. When the fire is to be fed fresh coals are placed in the tray on the top of the screw, which is then turned by a ratchet work moved by the poker. By the revolution of the screw the burning embers are raised up, and fresh coals deposited in the cavity underneath. —(See *Mechanics' Magazine*, March 4, 1859).

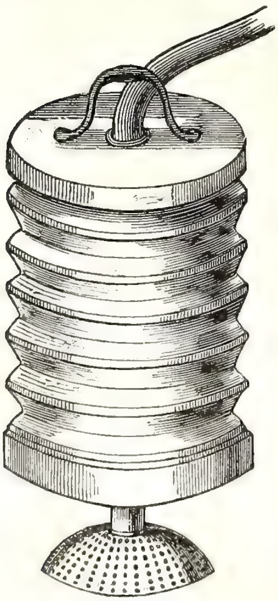
256. Patent Invention for Consuming Smoke in Stoves, Grates, Fire-places, and Furnaces; Thomas Bartlett, M.D., 7, King's-road, Bedford-row, W.C.

When this invention is applied to an ordinary grate (see woodcut) a horizontal grating *a* divides the fire-place into two compartments, *b* and *c*, and the fire-bars of the lower compartment *c* are made to move, so that coal may be readily introduced into that part of the fire-place. The fire is lighted in the upper compartment *b*, and after it has burnt up, the lower compartment *c* is opened by moving its fire-bars, and the fresh fuel is readily introduced by an ordinary fire shovel into the lower compartment. When the fire needs replenishing, the lower compartment *c* is opened, the well ignited fuel is removed by the aid of a shovel from the lower to the upper compartment, and the lower compartment is then again supplied with fresh coal. By making a side-hopper, or fuel-chamber, the fuel is readily introduced from the top, and in that case the fire-bars need no alteration. By making the bars of the horizontal grating hollow, and by causing a stream of water to pass through them, as in the larger model, this invention can be applied to any kind of furnace. (See *Leader*, Jan. 29, *Mining Journal*, Feb. 12, and *Builder*, Jan. 22, 1859.)



257. Apparatus for Purifying the Air of a Sick Chamber, or other Apartment; J. White, Finchley, N.

This apparatus consists of bellows, with valves at the top, opening inwards, and an aperture at the base connected by a pipe with a perforated metal plate. The air drawn into the bellows is forced downwards into a vessel of water placed beneath the bellows, and is diffused in the water by the metal plate. After purification by the water, the air passes into the room.

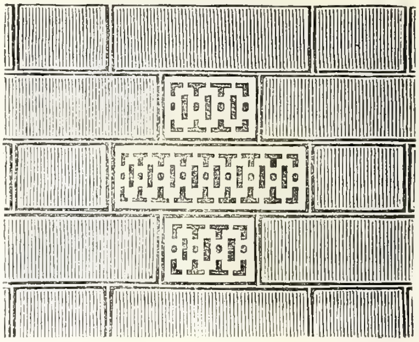


258. Apparatus for Propelling Purified Fresh Air into Buildings; J. White.

This apparatus consists of a bellows similar to that last described, with the addition of a covering, which forms a closed air-tight cavity on the surface of the water. A tube connected with this cavity conveys the purified air from the apparatus through the wall or other part of the building.

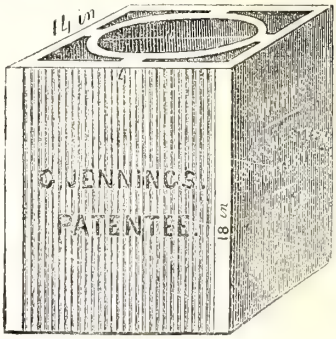
259. Patent Stoneware Air Bricks; George Jennings, Holland-street, Blackfriars, S.E.

These bricks are a cheap substitute for the iron air brick.



260. Patent Stoneware Bonding Bricks for Hollow Walls; George Jennings.

261. Patent Terra Cotta Smoke Fluepipes, with junctions for the passage or escape of impure air; George Jennings.

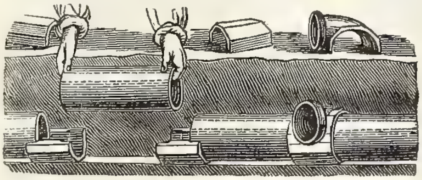


262. Improved Universal Ventilator; Syson Nibbs, Birmingham.

This ventilator contains a valve, which is regulated by a chain, with a cap and cover, to prevent down-draughts. It may be made of any size, for rooms, ships' cabins, or railway carriages.

263. **Patent Stoneware Drain-pipes, with Chairs and Saddles; George Jennings, Holland-street, Blackfriars. S.E.**

The woodcut shows the application of junctions to finish lines of drainage, without in any way disturbing the invert or general line of drain.



264. **Patent Improved Invert Blocks; Henry Doulton and Co., High-street, Lambeth, S.**

These blocks are connected by a lip, or proprojection, which unites them firmly together, and prevents the sewage from entering the lower channels, which are thus kept quite clear for land drainage.

265. **Patent Combined Smoke and Air Flues; Henry Doulton and Co.**

In this arrangement the air flue follows the line of the smoke flue, the passages being quite distinct. The heat from the smoke-flue causes a current, which carries off the vitiated air admitted by junctions near the ceiling. The pipes or blocks are all made to bond with ordinary brick-work. Where the blocks come together, each air-flue has a lip or projection, which enters the next block and completely shuts off the air-flue from the smoke-flue at the joint. This lip, with dowels at the opposite corners of the blocks, also holds the lengths firmly together. The smoke and air flues are made curved to suit any inclination.

266. **System of Drainage; Edward Jones.**

The various features of this system are as follows:—1. A drain and man-hole with tank. Filtering and deodorising apparatus, whereby the sewage is collected and a means provided for ventilating the sewers. 2. A gully trap and tank for collecting the *débris* of the streets, and preventing the effluvia from escaping; also area and yard traps, by the use of which the effluvia is stated to be prevented from entering the dwelling houses. 3. A closet pan, and traps with filtering tank, adapted for all water closets.

267. **Patent Imperishable Stoneware Sockets; Benj. Looker, Kingston-on-Thames, S.W.**

These sockets are composed of stoneware, the exterior being glazed. Each socket is made with a foot, or enlargement at the lower end, and the bottom is closed, so as to prevent any moisture from passing up from below into the interior of the socket. Fig. 1 represents a longitudinal section of this socket for receiving a telegraphic or other post; and Fig 2 is an exterior view of the same. It is made in three parts, *a*, *b*, and *c*; the lower part, *a*, is closed at one end, and has a foot formed to it; and at its other end is a socket to receive the lower end of the piece *b*, which also has a socket at its upper end to receive the end of the piece *c*. By constructing the socket in different parts in this manner, it is easier to fix the upright or post into it. It may, however, be made in one or any number of pieces. In order to prevent water entering the socket at the joints, they are rendered tight by cement, which is also employed to fix the post firmly in the socket. The use of sockets of this description protects the post from rotting off, especially at the point where it enters the ground, which is the part where decay first takes place; for this reason the upper portion *c*, of the socket may be employed without the parts *a* and *b*.

Fig. 1.

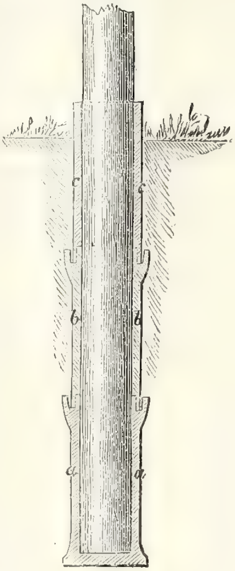
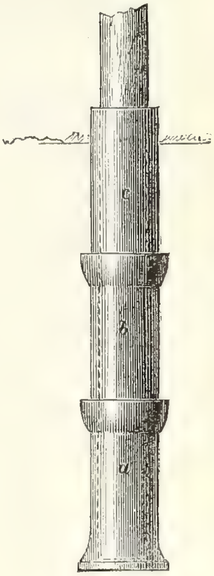


Fig. 2.



268. **Patent Socket Footings; Benjamin Looker**

These footings are made on the same principle as the patent sockets for telegraphic posts, &c. They are composed of stoneware, the exterior being glazed, the object of the introduction of these footways, is to supersede the use of brick or concrete foundations, and the ordinary stone footings to timber uprights. In figure 1 is shown a longitudinal section of the patent socket footing, and fig. 2 represents an exterior view. The socket footings are strengthened by having ribs in the interior or exterior, or both. They are made of various dimensions, to suit different sizes of uprights. It is intended that about 6 inches of the socket part of the footing

Fig. 1

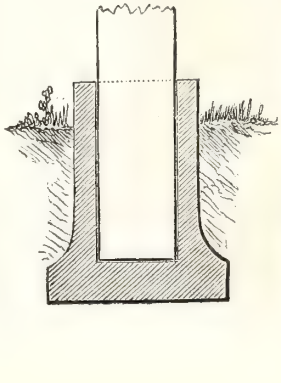
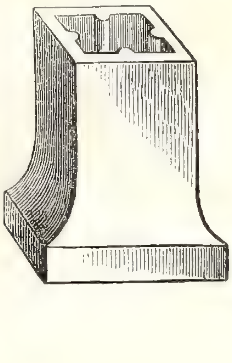


Fig. 2.



should be above ground, in order to prevent the timber from rotting off at the point where decay invariably takes place first. The uprights may be fixed in the socket with cement.

269. Patent Ventilator and Smoke Conductor; William Chadwick, Albert Works, Bury, Lancashire.

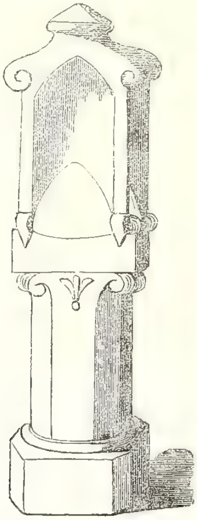
Within the chimney pot are placed two blades of a screw, similar to those of a marine screw-propeller. These are made to rotate by the action of the wind on a peculiarly formed cowl, composed of strips of spirally curved metal with diagonal strips of straight metal between them.

270. Patent Ventilator and Smoke Conductor; William Chadwick.

This is a modification of the above.

271. Bidborough's Patent Wind Guard; E. Corfield, 6, Burlington Mews, Regent-street, W.

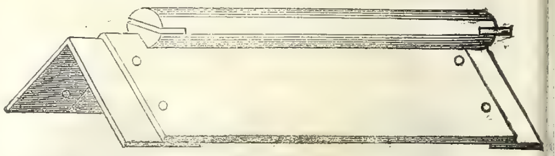
272. Patent Victoria Chimney Top; J. Zucheroni, 10, Millhill, Leeds.



This apparatus is divided at the top into four parts. In each part there is a moveable valve (the angles being covered). The wind, from whatever point it blows, closes one of the valves, thus protecting the chimney from its force; the other valves remaining open allow the free escape of the smoke. The article is of Terra Cotta, is 3 feet 6in. in height, and 14in. square at the base.

273. Patent Slate Ridges and Hips; Jones, Brothers, Bangor-wharf, Pimlico, S.W.

In this invention, the joints in the slate ridge are secured by rivetting a piece of metal under the joints of the flanges, and by inserting a tongue in the groove at the ends of the roll, thereby rendering the whole as perfect at the joints as at any other part.



274. Patent Waterproof Carton; P. M. Parsons, 9, Arthur-street West, London-bridge, E.C.

This is intended for roofing sheds and temporary buildings, and for lining damp walls, and is stated not to be affected by the hottest sun.

275. Specimens of Veneers Adapted for Fixing in Plaster Walls; the London Parquetry, Victory Works, Camberwell, S.

These specimens are veneered on cement, and may be applied at much less cost than the ordinary pannelling. They offer no inflammable body in case of fire.

276. Specimen of Wood Carving by Machinery; Cox and Sons, Belvedere-road, Lambeth, S.

This specimen consists of a bench-end with poppy head, showing three styles of carving to which the machine is applicable, viz.:—Cutting the tracery, which can be done from an outline pattern; working the crooked moulding round the outside edge of the bench, and carving the natural foliage in the poppy head. The specimen sent shows the amount of work that can be done by the machine, no hand-labour having been employed.

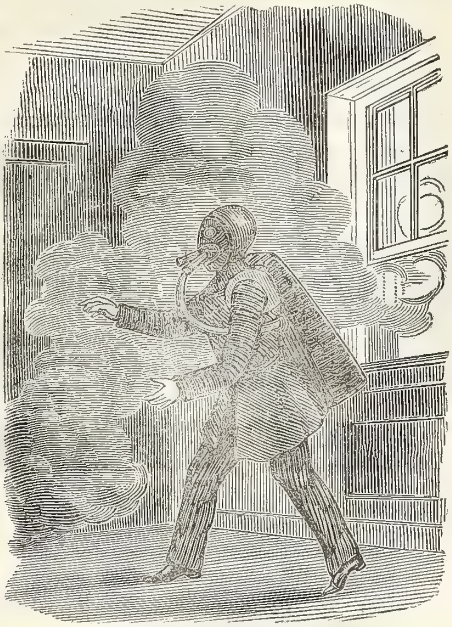
277. Specimen of Fret Cutting by Perin's Band Saw Mill; A. R. Perry, 20, John-street, Pentonville, N.

278. Telescopic Fire Escape, with Traversing Platform; John Bainard, Coventry.

By means of winches, the escape is elevated and the platform is then turned round to the window or roof of the house, so that a great number of persons may get on to it, and be lowered one by one by means of the basket.

279. Apparatus for Facilitating Respiration in the midst of Smoke and Noxious Gases; J. White, Finchley, N.

This apparatus consists of a mouthpiece of metal fixed to an air-proof head dress, descending round the neck, where it is to be closely enveloped by the ordinary clothing to prevent the access of smoke or gas to the lungs. Two pipes, with valves for breathing, are connected together at one end, and can be fixed to the mouthpiece. The inhaling pipe is in connection with a vessel of air which is to be attached to the body; the exhaling pipe is in communication with the surrounding air. The whole body and apparatus, when exposed to fire, may be enveloped in a loose dress of woollen fabric, saturated with water.



280. Patent Self-cleansing Water Cistern and Filter; James Rae, 1, Alpha-road, New Cross, S.E.

This invention renders it possible to scour the sides and bottom of the cistern every time the water comes in from the main, as the supply pipe extends to the commencement of the conical bottom, being turned round to form an angle of 45 degrees, thus creating a circular motion, which carries off the organic matter which adheres to the sides of the cistern. From the conical form of the bottom, the whole of the sediment descends to the lowest point, and is carried off by a pipe. The filter, which is also self-cleansing, is placed inside the cistern, and takes its own supply. It may be constructed as follows:—Instead of passing the water through a sponge in the top, the top is made close, and the water is allowed to rise up through the filtering matter into a chamber placed on the top of the filter. This obviates the necessity of changing and renewing the sponge, and the filter is said to be less liable to get foul. (See Drawing, No. 444.)

281. Patent Gauge and Syphon Tap; James Boyd, Lewisham, S.E.

This tap has a tube extending nearly to the bottom of the cask, so as to avoid the necessity of tilting. A vertical glass tube on the upper part of the tap forms the gauge, indicating the contents of the barrel.

282. Patent Guard for Water Taps; Joseph West, 234, Shales Moor, Sheffield.

283. Rotary Sashes for preventing Accidents from outside Painting and Window cleaning; John Harrison, Page's Walk, Bermondsey, S.E.

The sash is held in its position by metallic or wooden tongues fitting into the grooves in the sash and runner in the frame, making it completely weather tight. When required for cleaning or otherwise, a key or turnbuckle, operating as a lever, forces the tongue out of the receiver, and the sash can then be used on its centres; and in shutting the sash the projecting bolts at top and the studs on the sill force the tongue into the groove in the runner, and the sash is fixed in its original position.

284. Patent Ventilator; John Wainright, Birkenhead.

The lower portion of this window sash is perforated with several holes, at an angle to admit fresh air into the room, with an inclined plate within the room to diffuse the draught. There is a corresponding arrangement at the top to allow the foul air to escape.

285. Patent Self-coiling Convoluted Shutters; Clark and Co., 15, Gate street, Lincolns'-inn-fields, W.C.

The shutter is composed of laths, in metal or wood, which are connected by strips of tempered steel, that form the connexion between the laths, and also cause them to coil or roll themselves up into a circular space above, below, or on either side of the window. Grooves are formed, in which the ends of the laths slide, and, when the shutters are closed, keep the springs straight; the springs also counterbalance the weight of the shutter, which is opened and closed with facility.—(See *Builder*, June 26th, 1858.)

286. Self-shadowed Glass for Windows; Rees and Co., Seckford Works, St. James'-walk, Clerkenwell, E.C.

The glass is formed by softening sheet-glass in a kiln, and pressing it between dies, so as to impress the required design. Flashed-glass is employed where colour is introduced, and if the pattern only is desired to be in coloured relief, the flat portion of the coloured face of the sheet is ground off after it has been annealed.

287. Patent Window Blind; W. Bailey.

The roller of this blind rests in two semi-circular bearings; one end of the roller is acted on by springs, and the other by a flat endless band.

288. Pemberton's Blind Mount; Gibbons and White, 345, Oxford-street, W.

This mount is made without a spring, can be raised or lowered by the side cord, and will stop at any position, immediately the cord is released, by the weight of the blind causing a small catch to fall upon a cog-wheel attached to the blind end.

289. Patent Lock; Hamilton and Nash, Isle of Dogs, E.

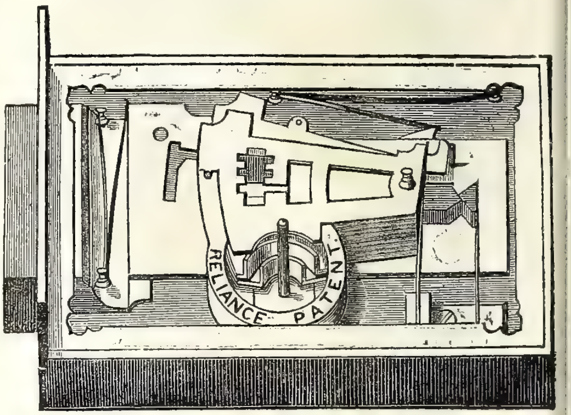
The bolt of this lock is not acted on by the key, but by a follower moved by a handle, so constructed that it disarranges the levers at the same time that it shoots the bolt, and thus the lock is locked without the use of the key. The bolt is so arranged that it shoots the width of the key farther than is necessary to clear the stump from the levers, and when fully shot, and only then, the key can be introduced into the lock, as it has to pass through a hole in the bolt which coincides with the key and the external key-hole. When the bolt is brought back, so that the stump is in contact with the levers, the key-hole is entirely closed, so that there is no means of getting any thing into the lock.

290. Open-Work Model of Patent Lock; Hamilton and Nash.

This lock resembles the former, excepting that here the bolt is moved by means of an escutcheon, and the levers are thrown by a triangular piece of metal, which is caused to rotate by two projections on the bolt striking it alternately when the bolt is shot forward and backward.

291. Patent Bank Lock; John Tann, 30, Walbrook, E.C.

In this lock the tail end of the bolt is formed of two plates, placed one over the other, the upper or rising plate forming the talon—these are hinged together at one end, with a slot at the other, so that if any force is applied to the talon plate before the tumblers are raised, the effect of such pressure causes the top plate to rise, immediately detecting the lock, and the slot catching against the back stump entirely takes off the pressure of the levers from the tumbler stump, so that the levers will not hang or indicate the height of the gating. The main stump is relieved from the pressure of the levers, so that if force is applied to the bolt, the levers will not hang or indicate the height of the gating through which the main stump passes; this is effected by a self-acting lever, working in the bolt and not operated on by the key. Supposing force was applied to the bolt for the purpose of picking it by any other instrument than the key, the effect of such force would be to cause the self-acting lever to hold in the bolt, and thus take the pressure of the stump from the levers, and it remains fixed until such force is removed, consequently, the very pressure, so fatal to other locks, in this affords additional security, and prevents the possibility of its being opened. The levers are protected by guards, which shut out the keys of all other patent locks. The guards are placed on several of the levers, either above or below them, so that even if a false key or pick succeeded in lifting the levers with unprotected fronts, it could not possibly raise those behind the guards, and the slightest extra lift at once fixes the detector, and then the proper key only can regulate it. A cylindrical nozzle is fixed to the outside of the face plate of the lock—in which is a circular piece of metal with a key-hole cut at right angles with the key-hole in the face plate of the lock, so that when the key is inserted, the key-hole in the nozzle is opposite to the one cut in the metal. The key-hole in the face plate being closed, the revolving metal in the nozzle is then turned by the action of the key, and brought opposite the key-hole in the face plate, closing up the aperture by which the key entered the nozzle, so as to always present a closed key-hole, whether the key is in or out of the lock. Thus it will be seen that the key-holes in the face plate of the lock and the nozzle not being opposite to each other, both can never be uncovered at the same time, and thus the introduction of any picking instrument is rendered impossible.



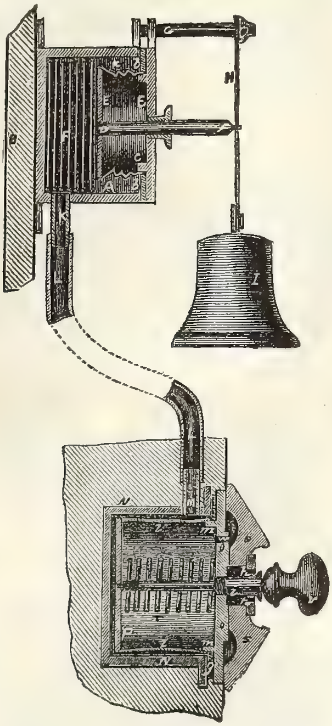
292. Model of Banker's Iron Safe, fitted with Blacket's Patent Inaccessible Lock; F. Blacket, 31, West Smithfield, E.C.

This invention proposes no alteration in the principles or construction of locks. It, however, success by placing the lock at the back of the safe, instead of on its doors, in obtaining the two conditions of security requisite; the lock picker can not get at the lock, and no amount of cutting or boring through the front of the safe by the burglar, can affect its security. A lock of any patent is so made and placed that it shoots its bolts upwards and downwards, which reach, and are hinged at their back ends to levers within the top and bottom casing of the safe; these levers have at their front ends teeth, which fit into corresponding recesses in the top and bottom of the doors for their whole width. When the bolts are shot out by locking, they press upon the back ends of these levers, and the front ends naturally rocking towards the door, the teeth enter these recesses, and the safe is locked. The lock is reached by a long handle into a slot in which is inserted, when needed, the true "key," which merely consists of the plate which rests upon the lock. This handle can be drawn out of the keyhole, just so far as to attach or allow of its removal, but cannot be entirely withdrawn. The inventor is thus enabled to make locks strong, with small and portable keys, while the lock picker is again baffled, for the key-hole itself is at all times partly occupied by the handle when the key is removed.

293. Rotating Disc Latch Bolt; R. Shaw, 15, King-street, Covent-garden, W.C.

This invention consists of a circular plate cut so as to admit of one of its portions being attached to a door, table, or window; upon the upper face of one portion of the plate a second disc is placed, carrying a spring bolt; this disc rotates on a centre, so as to allow it to be thrown across the door, table, or window, and to admit of the bolt being shot through a catch and socket, the asp and catch being attached to the second half of the first disc.

294. Patent Atmospheric Bell; John Willway, 29, St. Augustine's-parade, Bristol.



In this apparatus there is a length of ordinary gas pipe or other cheap tubing used as the medium of communication between a pair of strong and simple pneumatic valves or bellows, each enclosed in a small cast iron box. To one of these is attached the pull, and to the other the bell, and an impulse is instantaneously communicated from the one to the other. (See *Mechanics' Magazine*, November 13th, 1858.)

295. Patent Alarm and Detector; John Harper and Co., Albion Works, Willenhall.

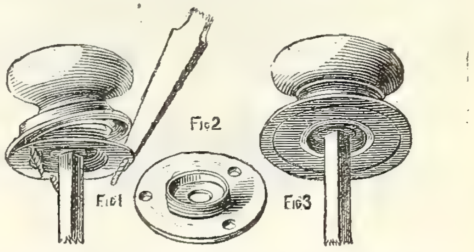
The object of this apparatus is to obtain, by means of a system of levers and connecting wires, acting upon the dial or index, an arrangement which shall possess the power of indicating, both by sight and sound, any burglarious attemps upon the doors or windows of a house, also indicating the part of the house upon which the attempt is being made.

296. Patent Lock Knob; Gibbons and White, 345, Oxford-street, W.

The rose plate is made with a mortised hob in that part of it which projects, so as to admit of a forked slide being dropped in—and the knob is made with a bush, which is grooved to receive the slide when the knob is applied to the rose plate in use. The rose plate is screwed to the door by a plain spindle passed through it and the follower of the lock. The knob is then applied, and the forked slide dropped in, effectually holding the knob, but allowing it to turn.

297 Patent Mount and Spindle for Lock Furniture; Pfeil and Stedall, Broad-street, Bloomsbury, W.C.

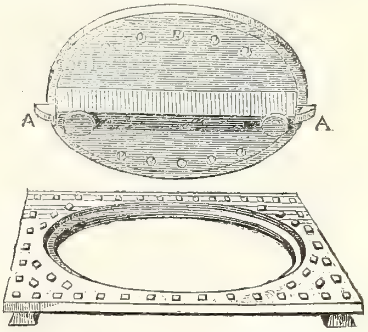
In this invention the under rose is so arranged that it can be detached.



298. Clark's Patent Door Knob; Hart and Son, Wych-street, Strand, W.C.

This knob has an adjustable spindle, one end having a nut screw, the other end being acted on by a spiral spring, so as retain it steadily in its position. The nuts and springs are within the knob.

299. Patent Coal Vault Plate; Pfeil and Stedall, Broad-street, Bloomsbury, W.C.

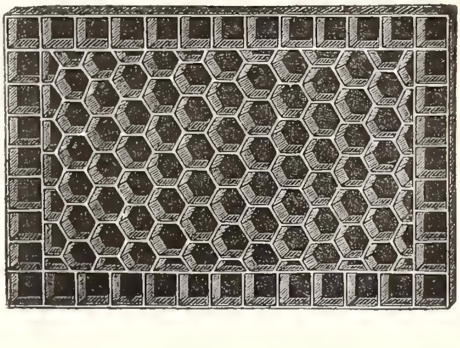


This invention has self-fastening bolts which cannot be unfastened from the outside.

300. Patent Adamas; S. Leoni, 34, St. Paul-street, New North-road, London, N.

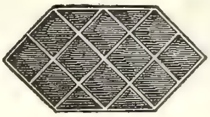
The specimens show the application of this material to door-handles, gas-burners, bearings, &c.

301. Patent Mineralised India-rubber Mats; William Warne and Co, 9, Gresham-street West, E.C., and Tottenham, N.



These mats consist of tubes of india-rubber, of various forms, placed vertically in contact with each other. No amount of wear can sensibly affect them; they thoroughly clean the feet like a brush, and the dirt removed falls through the cells formed by the tubes. They can be made with backs, by which means the dirt on removal of the mat is carried away.

302. Patent Mineralised India-rubber Brushes; William Warne and Co.



303. Patent Mineralised Kamptulicon; William Warne and Co.

This invention, applicable to the covering of floors and passages, consists in double proofing or coating strong canvass with a compound of india-rubber, ground cork, sulphur, and other materials, and then submitting the cloth to a vulcanising or curing heat, which prevents rigidity in winter and spreading in summer, makes the fabric extremely tough and durable, while great flexibility is attained.

304. Patent Carpet Sweeper; Newton, Wilson, and Co., 144, High Holborn, W.C. and 20, Old Bond-street, W.

The machine consists of a box, 14 inches long, 12 inches wide, and 4 inches deep, connected to which is a circular hair brush, which revolves by the turning of small wheels, and two tin compartments into which the sweepings and dust are conveyed. To the top of the box is connected a long handle, similar to that of a broom, by which the box is propelled along the carpet.

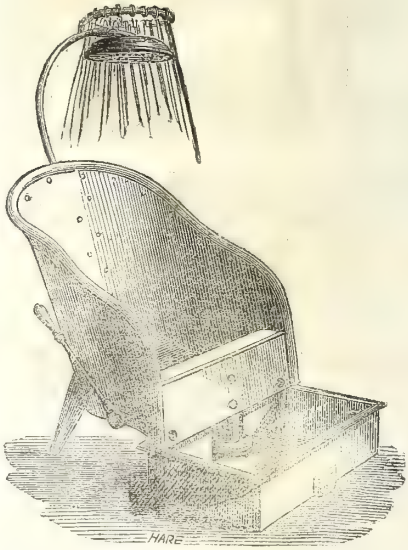
305. Patent Tubular Bedsteads; Thos. Allen, Hotwell-road Iron Works, Bristol.

The invention consists in forming castings or metal corner pieces, suitable for receiving tubular sides, foot and head rails, and also tubular uprights and posts. For these purposes, each of the corner pieces is formed in one piece, having two vertical projections and two horizontal projections at right angles to each other. The lower and upper vertical projections enter and fit the tubes which are to form the legs. The horizontal projections receive and fit into the tubes, which form sides, head, and foot rails. The models show a hospital bedstead with apparatus to assist the patient in rising, a reclining apparatus which can be adapted to any inclination, and a portable bedstead, which consists of two side rails of metal tubes made to fold by having a rule joint formed in them. The sacking or supporting fabric, at its edges, is sown over the side rails towards their ends, and on the undersides are fixed projections to enter the sockets of the legs or supports. The two pairs of legs used for each bedstead are crossed, and have sockets at their upper ends to receive the projections on the under side of the side rails. A full size bedstead packs in a case 8in.×5in. and 3 feet 2in. long.

306. Patent Hygienic Spring Lath Bedstead; Geo. R. Geyelin, 11, Heathcote-street, Gray's-inn-road, W.C.

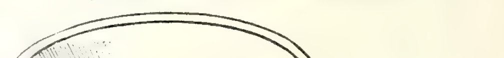
The peculiarity of this bedstead consists in connecting the laths to the frame by means of hinges in which are introduced vertical spiral springs.

307. Patent Bath; Robert Griffiths, 69, Mornington-road, N.W.



This bath is arranged so as to form an easy chair in a bed or dressing room. It can be used either as a foot, hip, sponging or shower bath.

308. Oxley's Patent Bath; Griffiths and Browett, 68, Bradford-street, Birmingham.



This bath combines a sponge bath, a hip bath, a foot bath, a bidet, and a nursery bath. The bather can have the feet immersed in hot water while sponging himself with cold.

309. Patent Mahogany Lavatory; George Jennings, 5, Holland-street, Blackfriar's-road, S.E.

310. Patent Mahogany Lavatory, with Enamelled Earthenware Splash Slabs; George Jennings.

311. Patent Mahogany Pedestal Water Closet for Dressing Rooms; George Jennings.

312. Patent Valve Closet and Trap, in one piece of Earthenware; George Jennings.

Fig. 1.

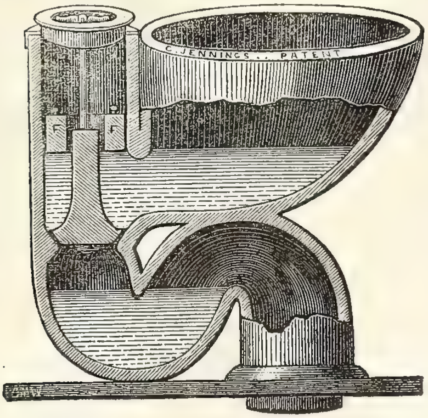
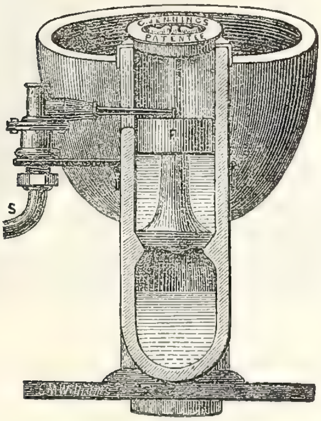


Fig. 2.



This closet is entirely free from machinery, the basin, the valve-seat, and the trap being complete, and are in one piece of earthenware. The D trap and fixing are dispensed with, and skilled labour is not absolutely necessary to the fixing of the closet. Fig. 1 is a view partly in section, the water being kept in the basin by the hollow plug or waste pipe, which at all times regulates the height of water. The lifting of the handle raises the hollow plug, and allows the contents of the basin to pass away; at the same time the float (EF), losing the water support, opens the valve, and insures an immediate wash, as also the required supply to the basin. Fig 2 is a view of the arrangement for supply, nothing more being needed than a common service pipe from the cistern or main to the union joint (S).

313. Patent Knuckle Washing Machine; T. Wheeler and Co., Albion Works, Oxford.

This machine has a revolving barrel inside and outside, on which clothes can be placed. This barrel works against compensating knuckle rubbers.

314. Patent Knuckle Washing Machine; T. Wheeler and Co.

This model shows an arrangement for placing the clothes between plates composed of knuckle rubbers.

315. Patent Washing Machine; T. Wheeler and Co.,

(See Drawings, Nos. 440 and 441.)

316. Patent Washing Machine; G. Weston and Co., 6, Pond-hill, Sheffield.

In this machine, when the handle is turned, a series of four frames, having two rollers in each, are caused to rise and fall alternately. The articles passing between these frames (an opening being provided for that purpose) are caused to be acted upon by these rollers, and thus a rolling, doubling, rubbing, and pressing operation is produced.

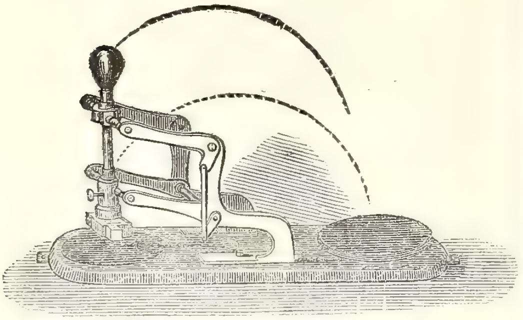
317. Juckes's Patent Washing Machine; W. Young, 33 and 34, Queen-street, Cheapside, E.C.

This machine consists of a pair of conical rollers, placed at right angles to a vertical axis in the centre of a tub, which axis is turned by levers extending over the sides of the tub. The linen to be washed is placed at the bottom.

MISCELLANEA.

(*For remainder of the articles in this Section see the Drawings.*)

327. Patent Parallel-Motion Endorsing Machine; H. R. Palmer, 181, Waterloc Bridge-road, S.



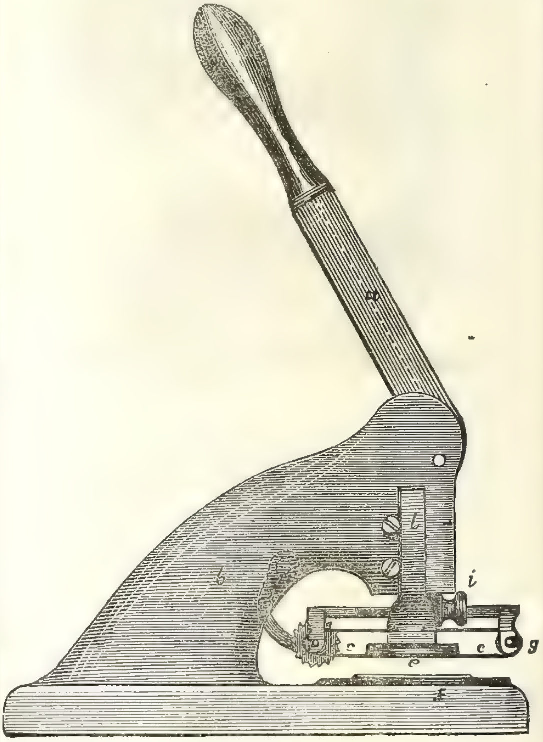
A stem or handle is made use of, to which are joined radius links or bars moving on fixed centres attached to the framing of the machine, and forming a parallel motion, whereby the movement of the stem or handle is guided in such a manner as to cause the surface of the stamp or die affixed thereto to meet the surfaces of the inking and stamping pads in a perfectly parallel manner, thereby ensuring its whole surface receiving a due amount of ink. The inking pads are made circular, having a tray for containing the ink, and covered with an absorbent material. The advantage this machine has is that the blow can be repeated as often as required in the same place, so that in marking linen or other fabrics it will be perfectly saturated.

328. Patent Endorsing Press; T. Gehrling, 15, William-street North, Caledonian-road, N.

In this press there is a double action. The die when depressed is brought on to the inking cushion, which is drawn from under it before it reaches the bed on which the impression is made.

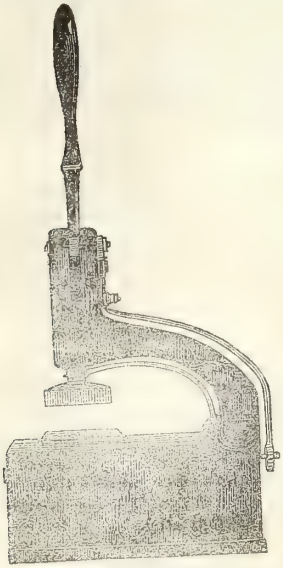
329. Patent Endorsing Press; Griffith Jarrett, 37, Poultry, E.C.

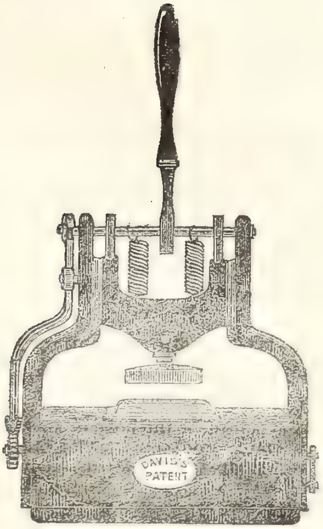
This press is intended for printing in colours without the use of fluid inks, carbonic or other chemically prepared paper, silk, or other suitable material being substituted. This chemically prepared material is formed into endless bands, which are stated to be capable of giving more than a thousand impressions before requiring to be changed. The stamping action of the machine brings continually a fresh supply of colouring matter to the die or type, so that there is no interval of time wasted between the successive impressions, and the press is always ready for use. The die or type-holder is attached to the slide of the press by means of a taper-dovetailed key, so that it can be instantly removed for changing the dates, or for being replaced by another die. Embossing dies with copper counterparts may also be used in this press.



330. Patent Endorsing Press; John Davis, 7, Coventry-street, W., and 19, Percival-street, Clerkenwell, E.C.

The improvement in this press consists in so arranging parts that one movement of the lever will cause the descent or motion of the printing surface, by which that surface will be inked; while another movement of the lever (in a contrary direction) causes the descent of the stamp or printing surface by which the printing or embossing, &c., is effected. The ink is enclosed in an air tight metal box. The lever of the press has an arbor or axis carrying a double cam, so that when the hand lever is moved from its position of rest in one direction, the one cam acts on the slide-carrying die or printing surface, causing it to descend; also, when such lever is moved in the opposite direction, it causes a like motion of die or printing surface by the other cam. With this other motion, however, a change takes place in the pad surface receiving the pressure of the die, or printing surface. This recipient of the pressure is mounted on a shaft, which, by the latter motion, is caused to make half a revolution, and so turns it upside down, by which means an inking or colouring pad is presented to receive the pressure of the die or printing surface when it descends, which thus becomes inked or coloured. In order to cause the motion of the ink pad, another cam, placed on the lever shaft or arbor, comes into action. In this direction of its motion, when the lever is released, the die or printing surface rises by the tension of its springs in the ordinary manner, when the cam moving the pad retires, a spring causes the return motion of the shaft carrying the pad, which is immediately reinverted, so as to present a pad to receive the pressure of the printing surface or counterpart of the die. If for embossing, the embossing or printing is then effected by the opposite motion of the hand lever. The cam moving the pad acts on the short end of a lever, the opposite end of which carries teeth gearing into a pinion on the pad shaft.





331. Secure Letter Box; F. J. Candy, M.A., Cambridge.

This letter-box consists of two chambers, an upper and lower one; the upper chamber contains a shoot, turning on a horizontal axis, the upper end or month of which can be drawn or pushed forward to receive the letters. When let go, the shoot falls back, by the weight of the lower end, to the vertical position, and the letters fall straight down into the lower chamber. A block between the two chambers prevents the introduction of any wire or pincers to draw out the letters, by completely stopping the lower end, or throat, of the shoot so long as the upper end or mouth is in the least degree open. This letter-box may be opened either by pulling out the upper end of the shoot with one hand, while the letters are dropt in with the other, or by pushing in a plate, which stands out in front above the top of the shoot, with the back of the hand which holds the letters, when the mouth of the shoot is pushed out, and the letters are dropt into it. The box may be made of different sizes, suitable for pillar-boxes, post-offices, and private doors.

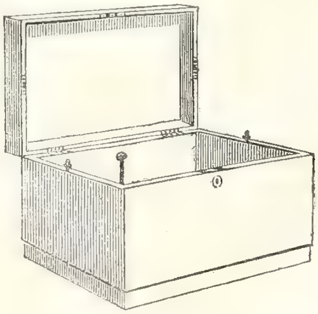
332. Improved Dabber for Engravers; Thomas Dixon, 4, St. James's-place, Hampstead-road, N.W.

This dabber is intended for laying etching and re-biting grounds. Its advantage consists in the ease with which the face can be changed for silk, leather, or other material, without disturbing the stuffing of the dabber, which retains its perfect regularity of form.

333. Dabber for Steel and Copper-plate Printers; Thomas Dixon.

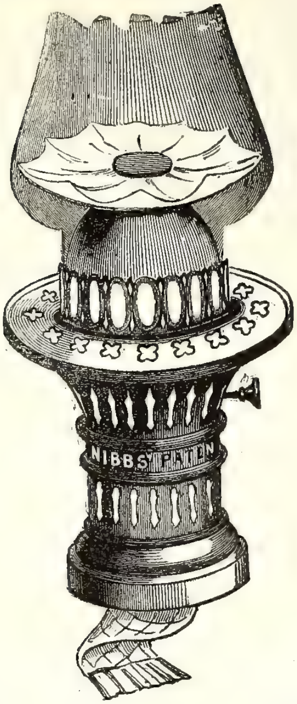
The dabber is filled with horsehair, to give lasting elasticity, and is so arranged that the cap or surface can be easily renewed as often as may be required.

334. Patent Telescopic Despatch Box; W. Child and Son, 51 and 51A, King's-road, Brighton.



335. Josee Johnson's Index or Book Mark; Thos. S. Woodcock, Manchester.

336. Patent Portable "Bude" Light; Syson Nibbs, Birmingham.



The accompanying woodcut shows this burner in use, (the oil vessel and part of the china being removed). The novelty of this invention consists partly in the peculiar arrangement of the parts, whereby no heat whatever is communicated to the oil vessel, and partly in the arrangements for admitting orygen to the interior and exterior of the flame. The cost is about a farthing per hour. The air to feed the interior of the flame is admitted through the lower portion of the wind-guard, and its connexion with that admitted to the exterior of the flame entirely cut off, the latter passing through the upper portion of the windguard, and through a perforated plate. The flame is then deflected horizontally by a button at the top. The oxygen, after leaving the perforated plate, issues through a cone, the top of which is considerably below the point of ignition, and the intensity and magnitude of the flame is regulated by moving the cone with the globe held upwards or downwards, the largest flame being when the cone is at its lowest point. The point of ignition is at least 3 inches above the junction of the burner with the reservoir, thus obviating all heat and shadow. The light, when burning at the rate of four hours for a penny, will illuminate a superficial extent of at least one thousand feet, and requires no attention when once lighted. It may be burned 100 hours without cutting the wick, and a wick will last several months.

337. Patent Portable Liquid Gas Lamps; Syson Nibbs.

This lamp is adapted for burning hydro-carbons such as petroleum, belmontine, &c. A wick, one inch wide, produces a brilliant flame an inch and a half wide by an inch and a half high, and the cost, at the present price of the oils, is at about the rate of eight hours for a penny. The great objection to burning these light oils in closed rooms has hitherto been the smell arising during their use, partly from imperfect combustion, and partly from the liquid partially escaping from the reservoir. This invention is stated to obviate this disadvantage. The parts are so arranged as to cause the least possible amount of metal to come in contact with the flame.

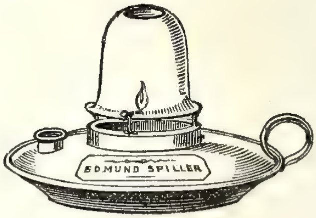
338. Boyd's Patent Economic Candlestick; Loveridge and Shoolbred, Wolverhampton.

In this candlestick the usual socket is dispensed with, the candle being placed upon a pin, and supported by a ring mounted on standards, which slide within the frame of the candlestick.

339. Patent Candlestick; W. H. Manning, Devizes, Wilts.

The object of this invention is to hold securely any sized candle, by means of a curved plate within the socket, moved to and fro by a screw when applied to a brass candlestick, or a spring in a tin candlestick.

340. Lover's Lamp; Edmund Spiller, 98, Holborn-hill, E.C.



The inventor states that these lamps requrie feeding only once a week, and require no trimming. They will burn for eighteen hours at one time, and then (with very slight attention) will go on for eighteen hours more. The arrangement of the oil-receiver is such that the oil cannot be spilt.

341. Patent Solidified Milk; J. Fadeuilhe, Misson, Bawtry, Yorkshire.

The specimens shown are in solid cakes, as well as in the granulated form in bottles. It is intended for invalids, emigrants, and others, and for use at sea. One part of the powder, rubbed up with ten of boiling water, produces a pure and wholesome milk.

342. Patent Hydrostatic Machine, for Coffee, Tea, &c., &c; E. Loysell, A. Inst. C.E., 131, Fenchurch-street, E.C.

This apparatus is intended for making infusions of vegetable substances, such as tea,coffee, dye-woods, malt and hops, beet-root, medicinal herbs, bark, and roots, and is constructed on the principle of direct hydrostatic pressure. The substance to be operated upon is placed between two perforated diaphragms, as shown in Fig. 1, and the liquid being poured into an upper reservoir descends through the substance, expelling the air from between the particles, and extracting all the useful parts, either aromatic, colouring, nutritious, or otherwise; afterwards, by opening the tops of the apparatus, the infusion percolates downwards through the substance a second time, thereby filtering itself, and is drawn off perfectly bright. When it is desired to operate on large quantities of vegetable substances, the substance is divided equally in several chambers, formed by the superposition of perforated diaphragms. The operation is the same as heretofore described. Fig. 1 shows a section of the apparatus adapted for domestic use, for preparing tea and coffee on the table. Fig. 2 shows the same apparatus, provided with a second vessel underneath, in which the infusion may be kept hot and good any time, being surrounded by a "Bain-Marie," and having heat underneath, this model being adapted for the use of large establishments. For manufacturing purposes the apparatus is constructed to act by steam power. (See Drawing No. 448.)

Fig. 1.

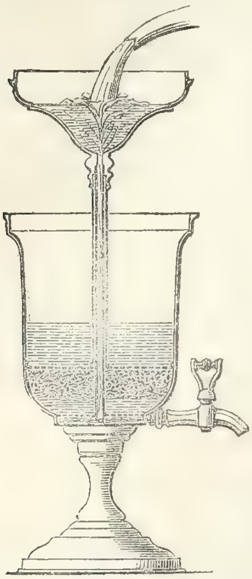
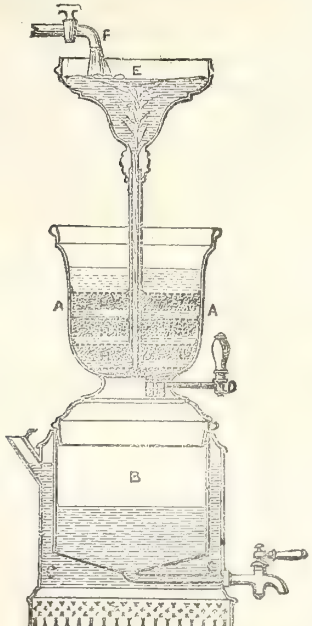


Fig 2.



343. Patent Self-Supplying Fountain; A. E. Galliard, 2, Seymour-place, Clerkenwell-green, E.C.

In the body of this fountain there is a piston, to which india-rubber bands are connected. There is an arrangement by which the piston can be wound up, and the elasticity of the india-rubber is made to act upon it so as to force up the water through the nozzle. (See Drawing, No. 447.)

344. Patent Transforming Baking Dish; E. Stevens, 5, 6, and 7, Cambridge-road, N.E.

This apparatus combines a stew-pan, hash-dish, potatoe, and meat baking dish.

345. Patent Reticule Muff; George Ellis, 4, Collier-street, Pentonville, N.

In this muff the space between the fur and the lining is formed into a bag, with a purse fixed within it.

346. Patent Elastic Hats; J. and F. Gillham, Oldham.

These hats have an opening in which is inserted a piece of elastic material, so as to allow them to expand, and prevent undue pressure on the head.

347. Patent Hat Ventilator and Railway Ticket Clip; E. T. Archer, Bridgefield House, Wandsworth, S.W.

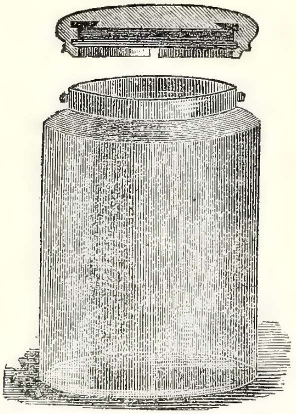
348. Elliptic Metron, for Hat Manufacturers; O. H. Hodges, 5, Crown-street, Finsbury-square, E.C.

This instrument is designed to remove the difficulty of measuring hats of eccentric form. A slide rule takes the length of the hat, and a travelling slide indicates the exact cross measurement at any distance from the back or front.

349. Patent Bottles for the Prevention of Accidental Poisoning; Savory and Moore, 143, New Bond-street, W.

These bottles are hexagonal in shape, with deep fluting or grooves running lengthways along the bottle. To the sight and touch they instaneously present most striking points of difference from any other kind of bottle. Vessels of this description, made in blue glass, are intended to be used for external applications only. For poisonous and powerful medicines, the dose of which is a tea-spoonful and under, bottles similarly shaped and fluted in white glass are proposed to be employed. The bottles are provided with a new contrivance, the effect of which is to make it impossible to pour out the contents otherwise than very slowly and gradually, almost drop by drop. This is accomplished by contracting the neck of the bottle at the lower part by the shoulder, and the mouth being of the usual size, the process of filling is but slightly affected by the contraction.

350. Patent Improved Air-Tight Jars; W. Pearce, 7 and 8, Bridge-street, Bristol.



The covers are lined with cork or other elastic material, and are fastened by a modification of the bayonet fastening. (See Drawing, No. 446.)

351. Fellows' Patent Brass Vent-Peg; Agents R. and J. Slack, 336, Strand, W.C.

This vent-peg is a conical screw, with a flat handle, which enables the vent to be opened or closed with facility.

352. Patent Imitation of Human Hair; E. Speight, 19, Woodbridge-street, Clerkenwell, E.C.

The materials used in this manufacture are the fibres of the Abaca Manilla, or other foreign hemps, which are dyed of the required colour, dressed and worked up into various ornamental patterns or designs, so as to form effective substitutes for head ornaments in natural hair. Head dresses and other ornamental articles manufactured according to this patent, are not only cheaper than those of human hair, but are stated to be lighter, cleaner, and less liable to becoming disturbed when in use.

353. Specimens of Products obtained by Lee's Patented Process for Manufacturing Mineral Oil; S. Lee, East Philip-street, Salford, Manchester.

This invention consists in distilling the oil contained in coal, cannel, schist, or other mineral bituminous substances, by combining them with asphaltum or pitch and by the application of heat, which dissolves the asphaltum, and causes the mineral bituminous substances to give off their oil in the form of vapour. The bituminous substances and the asphaltum are broken into pieces of any convenient size, and the whole is put into a common still, which is then closed and heated in the usual manner. The vapour is condensed in an ordinary worm, and the residuum may be used as fuel. Another feature in the invention is that the still may be heated as rapidly and to as great a degree as possible without injury to the oil produced, or waste from the production of gas; moreover, the oil produced by the single distillation is almost clear, the carboniferous and earthy particles of the mineral bituminous substances being retained in the still by the asphaltum, whereas in the modes hitherto adopted the products from coal, cannel, and schists have required a second distillation to separate the oil from the asphaltum. (See *Mining Journal*, June 5, 1858.) The specimens are as follows:—No. 1. Specimens of cannel and pitch used in distilling tar oil; 2. Burning leesine oil; 3. Lubricating leesine oil; 4. Paraffin; 5. Coke for fuel.

354. Specimens of Products Manufactured by Price's Patent Candle Company, Belmont, Vauxhall, S.W.

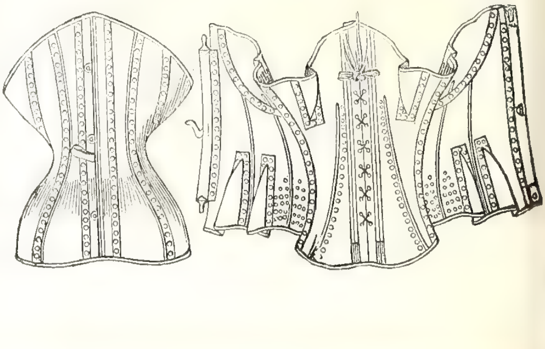
The specimens consist of Belmontine oil for lamps; lubricating oil for spindles of machinery; lubricating oil for shaftings and the bearings of heavy machinery; Sherwoodole for removing stains of grease on silks, satins, &c., Belmontine candles; Glycerine soap; Gishurst compound, for preventing and destroying the red spider, scaly mealy bug, thrip, and the green and brown fly.

355. Permanent Black Dye on all Textile Fabrics; James Day, 3, Bath-terrace, Queen's-road, Peckham, E.C.

The inventor states that all textile fabrics dyed by his method stand the action of the strongest acids and alkali, sea air and sea water, the atmosphere of all climates for any length of time, and may be washed and boiled in the usual manner with soap and water as often as requisite, until the garment or article is worn out, without in the slightest degree injuring the colour.

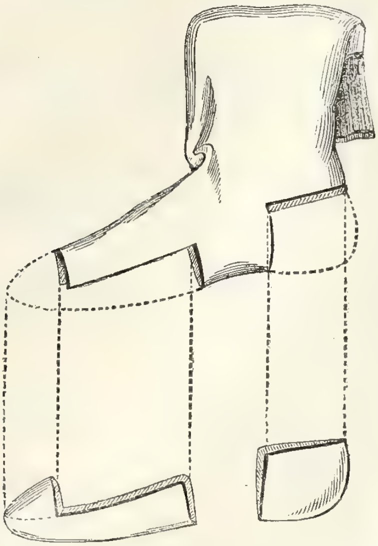
356. Specimens of Fabrics Rendered Non-inflammable; F. Versemann, 7, Bury-court, St. Mary Axe, E.C.

357. Castle's Patent Ventilating Corset; A. Salomons, Old Change, E.C.



This invention consists in a considerable number of perforations being made in the corsets by which they are rendered ventilating.

358. Patent Renewable Stocking; H. Owen, Swiss Cottage, Portswood, Southampton.



This stocking is so manufactured as to admit of the removal of the worn parts, and the supply of new, with no risk of disturbing the fabric, and without the necessity of darning or overlapping. By removing the worn parts, and supplying, at a trifling cost, a new sole or heel, the stocking will be made equal to new, and this operation can be performed in a few minutes. The woodcut shows the arrangement of the seams.

359. Patent Ladies' Shoes; Louis Leprince, 261, Regent-street, W.

360. Foot Warmers; J. H. Hume, Broughton Ferry, Dundee.

361. Prepared Vegetable Fibres for Paper making; W. Humber, Pancras Chambers, Pancras-lane, Bucklersbury, E.C.

362. Patent Apparatus for destroying Vermin; P. Dumont, Southwark-square, Borough, S.E.

This apparatus consists of an india-rubber ball with a nozzle, filled with powder, which, by pressure, may be forced out as required.

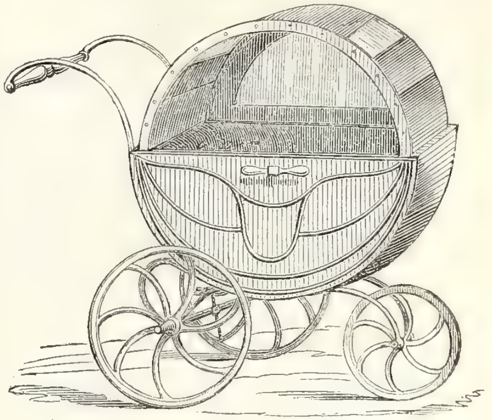
363. Patent Knife and Fork Cleaning Machine; Weedon and Rice, 41, Poland-street, Oxford-street, W.

This invention consists in keeping the knives to be cleaned flat upon the rubbing-board, by means of moving wedge-shaped pieces fastened to a T-shaped lever, which moves horizontally, placed beneath the board; the wedges or tongues working in eyes passing through the board, and being made to rise by spiral springs. The knives are cleaned by a hand-brush. After being released from the tongues, the knives are then simultaneously turned by a small handle above the knife receivers, to be operated on on their reverse side.

364. Patent Vegetable Leather; George Spill and Co., Old Farm House, Stepney-green, E.

This material is composed of a textile fabric coated on one side with caoutchouc and other matters. The grain, in imitation of the surface of leather, is given by engraved rollers. It is stated to be much cheaper than leather, and can be ornamented in the usual way by book-binders.

365. Patent Perambulator; J. B. Thomber, Great Russell-street, Bloomsbury, W.C.



This perambulator is so constructed that it can be made a double or a single, and a closed or an open carriage, with windows, or a bed. The body of the carriage forms a little more than a half circle, with slots or grooves inside, in which a semicircular hood or cover, made of light material, slides. The sides contain glass windows, moving on an axle, and capable of being turned up or down, so as to be a partial or an entire cover from both rain and sun. One seat folds so as to form a bed. There is a screw in the axle and spring, whereby to raise or lower the back of the carriage.

366. Model of Proposed Balloting Booth; Robt. Essery, 36, Berners-street, W.

The model represents an ordinary apartment,—with the front wall down—divided across by a screen; a space in front of this screen is railed off for desks for the persons appointed to verify the voters, and for seats for the returning-officer and candidates. Behind the screen are two divisions, each containing the requisite number of tell-tale gates or doors, which register the votes; the voter having had his right to vote verified, passes behind the screen, and through whichever of the tell-tale doors he pleases, and returning by the opposite side of the screen, passes out.

DRAWINGS.

375. Houston's Patent Smoke Consuming Furnace for Engine Boilers; F. W. Campin, 156, Strand, W.C.

This invention proposes to get rid of the smoke by destroying it in its nascent state, by means of gas flame applied at or near the back of the furnace, so that the smoke shall be consumed ere it reaches the chimney. In the drawing this is shown as effected by means of a hollow bridge, into which inflammable gas is introduced by one pipe and atmospheric air (to prevent the formation of a vacuum in the bridge) by another, the gas being lighted at a slit or perforations in the top of the hollow bridge, and the nascent smoke having to pass this gas flame is thus consumed.

376. Patent Improvements in Furnaces for the Better Combustion of Smoke; Thomas Almond, 22, Pickering-place, Paddington, W.

In the body of this furnace there is an inclined water space, on the upper surface of which a double series of fire-clay channels are placed, the series next the water-space forming passages for the products of combustion from below towards the upper part, while the other series of channels admit and conduct air to the same point of issue as the issue of the smoke channels. The air so admitted is heated in its passage, and mixes with the smoke and products of combustion, causing them to ignite, and thus to consume the whole of the combustible part. The admission of air is regulated by a suitable valve or slide at the ingress opening.

377. Patent Economic Smoke Consuming Steam Boiler; Price and Dawes, Wolverhampton.

(See Model, No. 8.)

378. Annular Cylinder Engines, for Screw Propellers; Joseph Maudslay, Lambeth, S.W., and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

In this arrangement the annular cylinder is placed above the crank-shaft, instead of below it, whilst the piston-rod cross-head is connected with the main-crank, on the propelling-shaft, by a connecting-rod passing from the piston-rod cross-head downwards, through the central or inner cylinder, to reach the shaft beneath.

379. Patent Rotatory Steam Engine; J. and E. Harthan, Congleton, Cheshire. W. and J. H. Johnson.

This engine is actuated by a jet of steam or air, which impinges on the curved bottoms of the chambers, and imparts a rotatory motion to the wheel.

380. Patent Marine Engine; J. A. Limbert.

(See Model, No. 7.)

381. Horizontal Engines of the Screw Steamer Metropolis; T. Meacham, Victoria Foundry Company, Greenwich, S.E. W. and J. H. Johnson.

382. Inverted Double Cylindered Expansive Marine Engines. W. Marshall, Leith-walk, Edinburgh. W. and J. H. Johnson.

383. Cylinder Trunk Marine Engines; Thos Richardson and G. W. Jaffrey, Hartlepool Iron Works, Durham. W. and J. H. Johnson.

The essence of the arrangement is the combination of three direct-acting steam cylinders, the several piston rods being connected to corresponding cranks, so as to work at equal angles to each other. This arrangement is stated to insure a perfectly uniform action, an increase in the effective power of the engines, and a saving in the wear and tear of the working parts.

384. Patent High-pressure Marine Steam Engine and Steam Generator; Neville and Dorsett, St. John-street, Lichfield, and Aldridge, near Walsall.

This engine is applicable to either screw or paddle-wheel propulsion, and also to land engines. The steam is generated by bringing, in the shape of spray, a small body of water, already heated to near boiling point, in contact with high pressure steam and a large heating surface of metal; the steam thus generated being superheated before entering the working cylinder, consequently the boiler and large body of water is dispensed with, and hence there is great saving of fuel.

385. Patent Universal Engine Governor. Price and Dawes.

(See Model, No. 10.)

386. Patent Adjustable Expansive Gear. Price and Dawes.

(See Model, No. 10.)

387. Marine Engine Spring Governor; Peter Jensen, 7, Mount-garden, Westminster-road. S.

This apparatus has for its object to prevent the great inequality in the speed of marine engines, which arises from the immersion and emersion of the propeller in a heavy sea. It consists of a cylinder placed inside the ship, under the water level, either on one or on both sides of it, and near to the propeller. This cylinder is fitted with a piston, on one side acted upon by the water, whilst the other side is counter-balanced by a spring; the piston is connected with the throttle valve of the engine. The more deeply the propeller of the vessel becomes immersed, the more the pressure on the piston increases. The connection with the throttle valve is so arranged that as the pressure on the piston increases, this latter is thrust against the spring opening the throttle valve, and *vice versa*. The drawing shows one arrangement of the apparatus in a screw steamer.

388. Patent Miner's Safety Cage; R. Aytoun, Edinburgh. W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

In these cages the actual winding rope or chain is connected at its lower end by a ring or hook, to which again is attached a double chain, connected diagonally to the cage, through the intervention of certain spring clipping levers. On each opposite side of the cage there is centred a duplex jamming or clipping lever, set upon a fixed stud centre, and disposed in opposite or reversed directions as regards each other. It is to the shorter arm of each of these levers that the double chain already referred to is attached, the two ends of the chain being attached respectively to a lever. This end of each lever has also a spring attached to it, the other end of these springs being connected to fixed studs upon the cage. The opposite longer arms of the jamming levers are formed with lateral projections, embracing the main vertical guides of the mine-shaft, the relations of the parts being such that, so long as the jamming levers are kept in a horizontal position, the cage can work freely up and down the guides; but when they are thrown out of the horizontal line, the lateral projections upon the levers jam firmly upon the guides on each face, and this occurs when the winding rope fails.

389. Patent Draw and Buffing Springs; Wright and Co.

(See Model, No. 47.)

390. Patent Continuous Railway Break; Meakin and Burrell, 3, Bucklersbury, E.C.

This invention consists in applying ropes or chains passing under and over levers attached to the blocks; these are wound up by means of a screw-wheel and drum, with a strong spring attached, so as instantly to take up all slack. There is also an apparatus for compensating for any slack caused by the carriages coming closer together when the breaks are applied, or for any variation in the distance between the carriages; also for holding fast the rope or chain in the event of breakage or disconnection.

391. Patent Improved Railway Turntable; B. Martin and C. J. Light, 26, Great George-street, Westminster, S.W.

This turntable, when not in use, has dead or solid bearings at points under the ends of the rails. In this position the rollers upon which it is to turn do not touch the roller path, and are thus preserved from injury during the passage of trains, while all that is necessary to prepare it for use is to raise these rollers by a simple arrangement of levers, so that the table is lifted off its dead bearings, and rests upon the rollers, in the same way as an ordinary roller turntable.

392. Patent Cup-trough Sleepers; J. Samuel, C.E.

(See Model, No. 57.)

393. Designs for Permanent Way. Christopher Hill, Chippenham.

(See Models, Nos. 51 and 52.)

394. Patent Plate and Channel Iron Permanent Way. J. W. Cruickshank.

(See Model, No. 56.)

395. Railway Chairs and Fastenings; R. N. Bow, 7, South Gray-street, Edinburgh.

In the annexed woodcut Figs. 1 and 2 show a method of fixing the rail in the chair by means of screws. In Fig. 3 a cylindrical wooden key is employed.

396. Patent Improved Carriages; C. Hadley, 37, Lower Hurst-street, Birmingham.

These improvements apply to every description of public and private carriage. They consist principally in altering or reversing the position of the present body (2 A, coloured yellow) enlarging it, and dividing or recessing the inside—in removing or simplifying the forecarriage—in forming the crosstree so as to be a substitute for springs and dumb springs—in curving the axle so as to lower the centre of gravity to within a foot of the ground, and form the draw bar by having the pole or shafts attached direct to it—in constructing a second or third body on the roof, or under the present body, so as to double or treble the present number of sheltered seats or cubical space without much increase of height or weight, and admit of a division of classes, whilst it separates the heavy or wet from light or dry goods. In the drawings the second or additional body is coloured lake, and marked B; and the third coloured green and marked C. In railway carriages the sides and divisions are made substitutes for the present underframing; and in "lorries," the distance between the wheels is reduced, or the width of the body increased by making the springs, &c., to work within the thickness of the sides, and employing peculiar metallic naves, as seen in 8, A, B, C, D and E.

397. Velocipede; T. E. Merritt, Rochester.

In this machine, the weight of the traveller, re-acting from an elastic seat, is the propelling power. A is the framing, to which is bolted the spring seat B. H is the guiding handle, turning in an iron arch, the axis being fixed to the middle of the fore-axle. CC are two mechanical legs, working on the centre D; EE are the forked iron toes. FF are two of Hodges' Accumulators, serving as springs to pull up the legs after each stroke. G is a stop, to prevent the legs being raised too high by the springs. The impulse is given by the foot pressing on the mechanical leg; as each leg straightens, the whole weight of the traveller rests on it and the seat B, thereby causing a powerful impulse forward. In this machine the wheels run on the axles, which are similar to those of a coach.

398. Pillar or Wharf Crane; Dunn and Co., Manchester.

This crane is constructed to lift 2½ tons. The pillar and foot plate are cast together, and the frame which carries the gearing is fitted with anti-friction rollers, and also carries the foot of the jib, which is made of wrought iron bars, with a pulley at the top for the chain.

399. Pillar or Wharf Crane; Dunn and Co.

In this crane the cast-iron jacket or case, which carries the gearing and brake, revolves upon a wrought-iron pin on the top of the pillar; the jib is made of cast-iron, with head pulley and chain, and is supported by strong wrought-iron tension rods from the top of the jacket.

400. Portable Crane; Dunn and Co.

This crane is constructed similarly to No. wharf crane, with balance box at the back, and mounted upon an oak carriage with wheels to move it along.

401. Portable Crane; Dunn and Co.

This crane is constructed similarly to No. wharf crane, with balance box, oak carriage on wheels and axles.

402. Pillar or Wharf Crane; Dunn and Co.

This crane is constructed with cast iron pillar, base plate, and jib made of two wrought iron bars fixed to a box or frame.

403. Steam Excavating Machine; Dunn and Co., Manchester.

This machine was designed for excavating the canal through the Isthmus of Suez. It is worked with engines of 12-horse power, and is calculated to excavate 45 cubic yards of sand, clay, gravel, or common earth per hour. In appearance it is similar to a swing pillar crane, with engine and boiler, mounted on a carriage with four wheels geared from the engine. The excavating bucket or scoop is attached to the blocks at the fore part, and is thrust forward into the earth by a double lever, at the same time it is being elevated by the blocks and gearing worked from the engine until filled, when it is swung round and emptied into the ballast waggons by drawing out the back part of the scoop with a lever.

404. Anti-Friction Press; T. A. Weston, Birmingham.

This press consists of four solid equal cylinders with a reciprocating plate interposed, which traverse on a plane surface as foundation, and under two equal inclined planes, formed in a part which rises and falls the height of the said planes as the plate moves to and fro, and which is in contact with the frame enclosing the whole, only with the intervention of loose rollers at its edges. The reciprocating rectilinear motion of the plate through a given space is converted into rectilinear motion at right angles through a space a 100th or 150th of the first, according as the height of the inclined planes may be made. The plate moves through twice the distance traversed by the cylinders. This answers to the long end of the lever—the short one being represented by the part having the inclined planes, and moving a distance equal to their height.

405. N. Harvey's Patent Steam Hammer; D. Cook and Co., Glasgow.

In this steam hammer, all the moving parts are malleable iron. The hammer ram is lifted by the cross-head through which the ram passes, and is fixed by a cotter bearing on the top side of the cross-head. From this cross-head descend two piston-rods, and pistons are on each side of the ram, working into two cylinders which, at the same time, form the hammer-guides and frame. One balance valve actuates both pistons at the same instant of time. The motion of the handle working the valve being the same in direction as that of the hammer, renders it convenient to give the strokes of the required weight and at the proper time. The cushion of compressed air which is formed during the descent of the piston, gives increased effect to the fall of the hammer, when steam is not used for that purpose; or, when steam of a less pressure than 30 lbs. is used, the air is allowed to escape into the exhaust pipe, and the hammer does its work by gravity alone. (See *The Engineer*, 3rd September, 1858.)

406. Patent Moving Cylinder Steam Hammer; John Condie, Glasgow; W. and J. H. Johnson, 47, Lincoln's Inn-fields, and Glasgow.

407. Mechanical Railway Chair Moulder; W. White, South Shields; W. and J. H. Johnson.

This railway chair moulder is stated to be capable of moulding 300 chairs per hour, when worked by two boys.

408. Patent Steam Riveting, Punching, and Shearing Machine; D. Cook and Co., Glasgow.

409. Schmidt's Patent Core Bar; D. C. Phillipson and Co., Manchester.

This bar is intended to be used without hay or straw bands. The several sections into which the core bar is divided longitudinally are hinged each at one extremity to an end plate, so that each section can fall inwards on its hinge, towards the central line or axis of the bar, after the other end plate supporting the free ends has been moved. When thus free from the article cast upon it, the removal of the core bar is easy.

410. Schmidt's Patent Ladles for Casting Metals; D. C. Phillipson and Co.

The metal, when poured from this ladle into the mould, is drawn from the lower part of the ladle, and the scum or slag floating on the surface is kept back.

411. Patent Brick Machine; Joseph P. Oates, Erdington, near Birmingham.

In this machine the moulds are filled by the operation of a compound Archimedean screw, having a less area of pressure than the area of the moulds, whilst all risk of damage to the machinery by undue strain, as well as wasteful consumption of motive power, are prevented by the escape of a column of clay, equal in sectional area to that of the screw; so soon as the brick has received its proper amount of pressure, which is regulated by the length of the tube or passage through which it escapes.

412. Patent Improvements in Kilns, Furnaces, Flues, and Drying-rooms; Johnson Hands, Epsom.

In kilns of this construction, instead of the heat being allowed to pass away at the top of the kiln into the atmosphere, the kiln is closed in at top in such manner that the products of combustion enter a flue which descends from the top of the kiln to a horizontal flue or flues, passing through the drying chamber, and such flue having made the desired circuit in the drying chamber, returns and passes through the kiln in contact with the furnace, so as to be highly heated. Openings, regulated by dampers, are left in the return flue within the drying chamber, by which the moist air is withdrawn, and the openings are left in the return flue, where it comes in contact with the furnace or fire-place, by which the flames of the furnace enter the return flue and ignite the gases and products of combustion as they pass away to the chimney. The drawing shows this system as applied to an arrangement of four kilns with drying rooms common to each kiln.

413. Patent Improved Method of Drying Malt, Hops, and other Produce; J. C. Plomley, Maidstone.

The improvement consists in introducing currents of heated air to pass over the surface of the produce to be dried, in addition to the ordinary method of passing heat through the produce. This causes a partial vacuum, by which rapid evaporation takes place at a low temperature, and carries off quickly the moisture arising from the ordinary drying fires. A in the drawing shows the roof; B the perforated drying floor; C a partition or flue, between which and the external wall, D, is placed, in addition to the central fire or fires, E, a side fire, F, one or more; G the cowl. The action of the whole is as follows:—The moisture arising (from the produce to be dried) by the action of the central fire E is immediately carried off by the current of heated air arising from the side fire, F, passing up the flue, C.

414. Patent Improvements in Refrigerators; W. P. Wilkins, Ipswich.

These improvements afford easy access for internal inspection or repair. The tubes, being without bends, may be seen through, simply by removing the two flat ends. Free expansion and contraction are allowed for by india-rubber joints, which also allow the easy removal of a tube without disturbing the others. The flushing cock, merely by being turned, admits of a strong current of water to remove any impurities, allowing the refrigerator to be used for a long time without being opened.

15. Machine for Preparing and Treating Jute, Hemp, Flax, and other Fibrous materials; Charles Bell Blyth, Dundee.

Fibrous materials, such as jute, hemp, flax, &c., require preliminary treatment known as "softening," and this machine is designed for the purpose, and consists in arranging three or four rows, tiers, or series of rollers mounted in the same framing, and driven by means of gearing. The material to be treated is fed into and between two rows of rollers, say the bottom and middle set of rollers, where three rows or sets of rollers are employed, and it is returned back again between the middle and top row or set of rollers, by means of a return feeder, which carries the material from between the first set or rows up to or between the next set or rows. Heating pipes are carried under and through the machine framing for aiding the process of softening.

416. Patent Washing, Steam-drying, and Wringing Machines, for flax, hemp, and other fibres, textile fabrics, &c.; J. J. Cregeen, M.D., F.R.C.P., Plough-road, Rotherhithe, S.E., and J. H. Dickson.

In these machines the undulating principle is applied to the cylinders, which, fitting into each other's surface, afford a much larger surface of contact, and do not let the material slip when wet, as is often the case with the round ones.

417. Patent Breaking Machine, for flax, hemp, and similar fibrous plants; J. J. Cregeen, M.D., F.R.C.P., and J. H. Dickson.

This machine consists of a central drum, having an undulating surface, toothed, which drum, when revolving, causes a beating action from smaller drums by which it is surrounded. The teeth are molar and canine, large and small, so as to change the position of the fibre on their surface. This apparatus may be propelled by any power, and is self-feeding.

418. Patent Scutching, Scraping and Brushing Machine for Flax, Hemp, and similar Fibrous Plants; J. J. Cregreen, M.D., F.R.C.P., and J. H. Dickson.

This machine is self-feeding, treble beating, scraping and brushing combined, and by means of its direct action will scutch fibre of almost any length. The tow, by being cleared of the shives before its separation from the fibre, is as valuable as the long fibre itself, that from many of the East and West India fibres, being almost as fine as silk. Waste is thus prevented.

419. Patent Yarn Winding Machine; Robertson and Orchar, Wallace Foundry, Dundee. W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

A frictional disc connection between the driving shaft and the winding spindles serves to secure an unvarying take-up velocity to the filling bobbins as they wind on. With this arrangement, the rotary speed of each spindle depends upon the distance from the centre of its disc, and of the point of contact of the disc on the horizontal shaft, and this can be varied by the lateral movement of the spindle.

420. Improved Grease Cup; J. Evans, Iron Steam-Boat Company's Works, Nine Elms, S.

The improvement in this cup consists in admitting the tallow, &c., direct on to the slide, instead of the old method of letting it in through the cylinder cover.

421. Patent Blocking Machine; John Samwells, Dunstable.

This machine is for blocking straw hats and bonnets, and is heated by steam.

422. Patent Wood-cutting Machinery for Irregular Forms; Arthur Kinder, Worcester. W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

This machine consists of a peculiar arrangement of cutter-head and mode of fixing the cutters therein; such cutters being either applicable for plain or moulded surfaces—the cutter being made to correspond to the form of moulding to be produced. The cutter-head consists of a solid cylinder, slotted down the centre, and the cutters are fixed inside the slots by screws or pins, such screws or pins passing through the cutters into back plates which direct the shavings away; or a conical plug may be used, forced between the back plates. The mouth of the cutter, when one is used, may be formed by fitting a pillar in front of each cutter at a suitable distance therefrom. This cutter-head is carried by a vertical spindle, having a vertical adjustment in any convenient manner. For working on surfaces which have been previously rounded, an adjustable flexible curved table-top is employed. This table, with the flexible top removed for plain work, is made to turn on centres, so as to be adjustable at any desired angle for the pupose of cutting bevelled work. A longitudinal traversing motion is imparted to the cutting table, in conjunction with a transverse traversing motion imparted to the wood to be cut; such motion being effected either by hand or by mechanical means. A simple arrangement of slots is employed for guiding the wood and its pattern or template across the table. In applying a portion of these improvements to vertical saw frames, the wood to be cut is fitted in slots or on slides in a circular table, which is free to be tilted or adjusted angularly whilst it revolves round the saw. The saw passes through the centre of the table, and the table itself is capable of revolving round the saw.

423. Balestrini's Telegraphic Cables; Perreaux and Co., Mark-lane, E.C.

In the drawings, Fig. 1 shows a side view and section of the core of a cable intended to be immersed at a slight depth, the covered wires forming the core being laid parallel to each other; but when the cable is intended to be immersed at a great depth, the covered wires are wound spirally around a small cord or curved wire, as seen at Fig. 2, or around an iron wire covered with hemp or other fibre, as seen at Fig. 3. These cores are then surrounded with hemp or other fibre, rendered waterproof, as seen at Fig. 4, where the core has twisted around it eight cords, each composed of four strands. The cable thus made is then passed between grooved rollers, so as to compress the cords around the core, and so as to prevent it from stretching when being laid down. The twisted cords are rendered waterproof by saturating them with a mixture of raw caoutchouc and pitch. The cable is stretched and bound round closely with iron wire, strips of zinc being placed horizontally between the coating of wire and the cable, which gives rise to a chemical and electrical action, keeping the outside coating from rust, and producing a calcareous deposit, by which it is much protected. If the cable is to be immersed to a considerable depth, long open spirals of iron wire are placed between the cable and its covering of galvanised wire, as seen at Fig. 5, the spirals running in the opposite direction to the coils of the cord. The iron wire composing these spirals not being galvanised, the same action takes place between galvanised and non-galvanised wire, which preserves the cable until the calcareous deposit is produced. In places where the cable is likely to come in contact with rocks, it is protected by having steel wire wound round it. Figs. 6, 7, and 8 show the parachute employed for facilitating the laying of the cable. In certain cases, when the parachutes would not be suitable, floats, filled with any substance soluble in water, may be substituted. (See specimens, No. 159.)

424. Instrument for Drawing Volutes; T. E. Merritt, Rochester.

This instrument consists of a heavy base of iron A, B, C, as shown in the drawing, to which is clamped a metal wheel D. The axis E passes through this wheel, and its handle end turns in the standard B. To the lower end of the axis there is a short bar of brass soldered, F, which terminates in a slotted guide, G. This piece of brass is bored throughout, and is fitted with a hollow tube, which is in one piece with the jaw, H, in which the running wheel, I, turns. The tube can be set to any position by the set-screw working through the brass piece. The running wheel, I, is tapped through its centre to serve as a running nut to the screw, K. This screw has a sliding block attached to the farther end which runs in the slotted guide, G, and carries a pencil below. When the handle is turned the running wheel, I, (which is edged with india-rubber) revolves by its friction against the fixed wheel, D, and thereby causes the screw to move outwards, and to bring the pencil away from the centre towards the circumference of the volute to be drawn. It will be seen that the interval between the lines depends on the distance of the wheel, I, from the centre of the fixed wheel, D; the nearer to the centre of D, the smaller the spaces. The diameter of the volute is equal to the diameter of the fixed wheel.

425. Patent Ringing Machine for Chiming Church and other Bells; W. Jones, Pendleton, near Manchester.

This machine is constructed of iron cog wheels, cam lifts, and levers, the cams pressing down the levers, and in their turn raising the clappers which strike the bells. The wheel at the end changes the peal, which is done by raising the catch and turning the wheel round one third, each horizontal shaft having a different peal or chime. The machine is complete in itself, and stands in a space of 3ft. by 2ft. 6in., and is put in motion by turning the handle.

426. New Artificial Foot, for Chopart's Operation; Kenneth H. Cornish, 5, Essex-court, Middle-temple, E.C.

This instrument restores the elastic arch of the foot, and enables persons who have had the front part removed to walk with a springy tread, at the same time preventing all chance of pain from pressure on the front of the stump. A metal socket is accurately moulded round the stump, especially where the ankle joints project, the front part only being left uncovered; from this a solid metal heel projects backwards, while from beneath the sole (which is slanted upwards) five strong springs, so curved as to complete the arch as in the natural foot, pass forward; five weaker springs, impinging against a metal arch, the extremities of which do not press on the front of the stump. A stuffing of cotton wool and a covering of leather allow the shape of the natural foot to be imitated, without interfering with the action of the springs. A stout sheet of india-rubber must be placed between the springs and the leather at the sole, to prevent the latter from being cut through by friction. The apparatus simply requires a strap to fix it, and only weighs from 12 to 24 oz. The drawing represents—1, a lateral view of the uncovered instrument; 2, ditto with the stump secured; 3, the appearance of the foot when completed.

427. New Artificial Leg; Kenneth H. Cornish.

This leg is constructed on somewhat similar principles to those shown in the foot. The pin is shifted more forward into the position occupied by the principal bone in the human leg, and rests upon an elastic arch composed of five springs for the front pier or toes, and two for the posterior pier or heel. A stuffing of wool, and a covering of leather or canvass, complete the apparatus. A leg for a working man can be made for less than a pound more than is charged for the old pin leg which is compared with it in the drawing. (See *Lancet*, October 21, 1857.)

428. New Artificial Foot; Kenneth H. Cornish.

The drawing is from a photograph of the skeleton of an apparatus made for a girl aged 13, who had the front of the foot removed five years previously, and was unable to walk from the intense pain created by pressure on the front of the stump. Arrest of development followed, and shortening to the extent of 3½ inches. The case being one of extreme difficulty, a leather bucket was accurately moulded to the stump, and lined with soft leather. A metal cup at the bottom of this was attached to a block of wood, and the seven springs were secured in the grooves, where they rested in the wood by a thin plate of hammered steel. No iron side-bars were used, it being found that the two straps represented kept the apparatus firmly and comfortably fixed. As each spring is distinct in these several inventions, any single one which may be broken by accident, &c., can be replaced with ease. (Vide. Trans. Med. Society, London, in *Lancet*, 1858-59).

429. Vapour Bath for Local or General Fumigation with the Vapour of Calomel or other Drug; Kenneth H. Cornish.

This apparatus consists of a gourd-shaped, wide-mouthed vase of very thin glass, to the neck of which a linen tube is attached, a spirit lamp, and a wire stand. The drug to be volatilized is placed in the jar, which is then submitted to the action of the spirit lamp. When used locally, the finger, or other part upon which it is desired to act by the vapour, is plunged within, or held at the mouth of the jar, and the escape of the vapour prevented, by holding the linen tubing (previously dipped in oil) closely to the surface of the skin. When an ordinary vapour bath is to be given, the jar should be used without any tubing, the patient sitting on a chair over the apparatus, and beneath a thick blanket. (See the *Illustrated Inventor*, April 17th, 1858.)

430. Patent Sculling Propeller; John Buchanan, Greenock. W. and J. H Johnson, 47, Lincoln's Inn-fields, W.C., and Glasgow.

431. Submarine Screw Ship; George Cheek, Boston, Lincolnshire.

432. Lee's Water Tank and Life and Treasure Buoy; Lansing, Star, and Co.

See Model, No. 130.

433. Balestrini's Electric Sound; Perreaux and Co., Mark-lane, E.C.

See Model, No. 136.

434. Portable Iron Huts for Soldiers' Encampments, &c.; C. T. Guthrie, Clarence-place, Dover.

These huts are designed principally with a view to cheapness, lightness, portability, durability, and rapidity and ease of erection and removal, with due regard to comfort. The hut (Fig. 1) is formed of flat galvanized iron plates about 1-20th of an inch thick, secured together at the edges as represented in details A. B. No plate weighs more than 20lbs. The floor is formed of corrugated iron plates, with the edges turned down at right angles, and resting upon flat iron sleepers. The windows have thin cast-iron circular rims covered with vulcanized india-rubber bands, and are simply pressed into the holes in the plates. There is a stove provided with a telescopic chimney attached to a conical ventilator at the apex of the hut. The ventilator can be lifted or depressed by simply turning a handle (see section). In building the hut, the floor and walls should be first erected, the conical roof should then be put together independently and lifted into position (it weighs about 3 cwt.). The various parts of the hut are so contrived that they can all be packed in a small box, the sides and top and bottom of the box forming tables and benches for the men when the hut is erected. Fig. 2 represents another design. Here it must be noticed the plates are perfectly flat when disunited; but, as well as the angle pieces, are sufficiently thin to allow of their being bent as represented in the sketch.

435. Rowley's Patent Turnip Duster and Fly Destroyer; Priest and Woolnough, Kingston-on-Thames, S.W.

The object of this invention is to throw lime, soot, and other composition upon young turnip plants, to protect them from the ravages of the fly and other insects that infest them. The composition is dusted on to the plants by means of a powerful artificial wind, produced by revolving fans, which are put in motion by the travelling wheels of the machine.

436. Gas-Regulating Valves; Cockey and Sons, Frome, Somerset; W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

437. Sanitary Gas Stove and Standard for Gas Light; R. W. Giblett; F.W. Campin, 156, Strand, W.C.

By the arrangements here proposed the necessity for ordinary smoke or foul air funnels to gas stoves is stated to be dispensed with. A short funnel, which forms a pillar or standard for a gas light for lighting being substituted, the effect of the light at the top of this short funnel being to induce the smoke and foul products of combustion to pass to the top of the room, whence they may be removed by proper top ventilation, the top of the gas light being made sufficiently high to carry the products of combustion above the heads of the persons in the room.

438. Ventilating Gas-Lamp for Drawing-rooms; T. C. Hine, Regent-street, Nottingham.

In this lamp the products of combustion are collected in a glass dome, and passed through a tube into the smoke-flue of the apartment. There is an arrangement of valves by which fresh air can be admitted, either heated or not, so as to either raise or lower the temperature as required.

439. Iron Stack Flues; C. J. Richardson, F.R.I.B.A., 9a, King-street, Whitehall, S.W.

In these drawings, it is proposed that the chimney stack should be reduced to half the usual size, the principle affording scope for improved design, and being at the same time a means of preventing down draught. There is a rain-vase on the stack, which is stated to separate the blacks from the smoke.

440. Patent Steam Washing Machines; Thos. Wheeler & Co., Albion Works, Oxford.

Fig. 1 is a barrel placed diagonally on an axis, with clothes placed inside; its motion is throwing the clothes violently from one end of the barrel to the other. Figs. 2 and 3 show the hot water apparatus. Fig. 4 represents a washing machine placed on the top of a portable engine boiler. The clothes can be boiled after washing, and then wrung by passing them between two hollow metal rollers. At the same time clothes can be thoroughly dried by heat from the engine. This can be used to go from place to place as a portable washing machine. Fig. 5 is an elevation of fig. 4.

441. Patent Washing Machines; T. Wheeler & Co..

The drawing, fig. 10, shows a reciprocating motion, stated to save from 50 to 60 per cent in labour. Fig. 15 represents a rotary barrel; the clothes can be placed both inside and outside the barrel; as the barrel revolves, the levers cause the brushes to act on the clothes. Fig. 16: This machine will wash inside and outside the barrel, the same as fig. 15, the clothes being placed underneath the tapes outside the barrel, and smaller articles thrown inside the barrel. The rubbers float upwards by their own buoyancy. Fig. 18 represents a double rotary cylinder machine, with barrel similar to that in figs. 15 and 16, traversing round a tub. This machine is intended for very large establishments. Clothes may be placed both inside and outside each barrel, on the circle at the bottom of the tub. Fig. 20 is a machine fitted with brushes in connection with an endless net (as shown in fig. 12). The endless net passes gradually round the two rollers. Circular brushes brush the clothes as they pass in and out the water. Figs. 13 and 14 can also be used as a reciprocating motion with the endless band instead of circular brushes. (See models, Nos. 313, 314 and 315.)

442. Patent Improved Vertical Mangle; George Halkerston, Freuchie, Fife, N.B.

The mangle consists of a pair of vertical parallel standards, of cast-iron, held together transversely by horizontal tie-rods and stays. These binding details consists of bars of wood, interposed between the standards, so as to abut at their ends against the standards, and their tension rods of metal laid parallel with the wooden bars, and bolted at the ends through the standards. In this way, the framing is both trussed or stayed and tied together. The actual mangling details consist of a pair of wooden rollers, of large diameter; the upper one of of which has attached to it the ordinary taking-in cloth. The end journals of the lower roller—on which the pressure comes—rest in each case upon a pair of anti-friction disc wheels, the stud spindles of which run in bearings, carried by an adjustable block or saddle piece, let into an opening in the standard. The end journals of the upper roller run in vertically adjustable bearings, fitted into slots in the main standards above—the pressure upon the pair of rollers being regulated by a compound plate spring, the two ends of which bear upon the bearings or their holders, whilst the centre of the spring is pressed upon by a screwed stud-spindle, fitted with an adjusting hand wheel. One side of the mangle is furnished with a hinged folding table.

443. Self-acting Registering Cask Tilter; G. Bursill, Jun., 1, Belvedere-road, Lambeth, S.

This invention consists in the combination of a spring balance, with a stillion or cask supporter, the object being to facilitate the withdrawal of liquid from a cask without disturbing the sediment. It not only tilts the cask, but at the same time registers any quantity of liquid, that may be withdrawn in pounds or pints, &c., as may be desired. Fig. 1 is a view of the tilting apparatus applied to a cask containing liquor, part of which has been withdrawn. Fig. 2 is a view of the tilter, the face of which is so marked as to register pints, &c., on one side, and pounds, &c., on the other. Fig. 3 is a view of tilter, with part of index removed to show spring at back, enclosed in a tube or barrel.

444. Patent Domestic Self-cleansing Cistern and Filter; James Rae.

(See Model No. 280.)

445. Patent Mechanical Street Sweeper; L. Tindall, Sherwood Foundry, Mansfield, Notts; W. and J. H. Johnson, 47, Lincoln's-inn-fields, W.C., and Glasgow.

446. Patent Capped Bottles and Jars; Pearce and Co., Bristol.

(See Specimen No. 350.)

447. Patent Self-supplying Portable Fountain; A. Galliard.

(See Specimen No. 343.)

448. Patent Hydrostatic Machine for Coffee, Tea, &c.; E. Loysell, A. Inst. C.E.

(See Specimen No. 342.)

LIST OF EXHIBITORS.

N.B.—The figures after the names refer to the numbers in the Catalogue.

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MEETINGS FOR THE ENSUING WEEK.

MON. ......Actuaries, 7.
TUES. ......Medical and Chiring 8½.
WED. ......London Inst., 12 a.m. Anniversary.
Royal Soc. Literature, 4½.
Society of Arts, 8. Mr. J. Arthur Phillips, "On the Metallurgy of Lead"
Archæological Assoc., 8½.
THURS .....Numismatic, 7.
London Inst., 7. Prof. Bentley, "On Vegetable Substances used for the Food of Man."
Philological, 8.
FRI. ......United Service Inst., 3. Major-Gen. Portlock, "On the advantage of cultivating the Natural and Experimental Sciences as promoting the Social Comfort and Practical Utility of Military Men."

PATENT LAW AMENDMENT ACT.

◆

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 15, 1859.]

Dated 12*th March*, 1859.

636. J. Thornton, Liverpool—Imp. in machinery for the manufacture of bricks, tiles, and other similar articles.

Dated 16*th March*, 1859.

658. C. Parker, Dundee—Imp. in looms for weaving.
666. E. Anscombe, 95, Westbourn-street, Pimlico—An apparatus for taking an accurate delineation of any view or object in open air or otherwise.

Dated 17*th March*, 1859.

676. R. A. Brooman, 166, Fleet-street—Treating barley so as to obtain new alimentary substances therefrom. (A com.)

Journal of the Society of Arts.

FRIDAY, APRIL 29, 1859.

EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th inst., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONI.

The Council have arranged for two Conversazioni during the present Session; the first, on Saturday, the 7th May, at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th May, at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman. Cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

Members of Institutions who are anxious to attend either of these Conversazioni, are requested to apply to the Secretary of the Society of Arts, through the Secretary of the Institution to which they belong.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

TWENTIETH ORDINARY MEETING.

Wednesday, April 27, 1859.

The Twentieth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 27th inst., Robert Hunt, Esq., F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Corderoy, Edward
Foster, William
Griffiths, Robert
Jarrett, Griffith
Marshall, Samuel
Shaw, Thomas
Werry, F. A. W.
Whitehouse, E. O. Wildman
Wilson, Richard

The following Institutions have been taken into Union since the last announcement:—

Skipton, Mechanics' Institution.
Wallingford, Mechanics' Institution.

The Paper read was—

ON THE METALLURGY OF LEAD.

By John Arthur Phillips.

Although lead forms an essential element in a large number of minerals, the ores of this metal are, strictly speaking, far from numerous. Of these the most important is sulphide of lead, or galena. This mineral, which possesses a metallic brilliancy, and has a lighter colour than metallic lead, presents, in its cleavage, all the variations, from large facettes and laminæ indicating a cubic crystallisation to a most minutely granular structure. It is extremely brittle, and its powder presents a brilliant, blackish-grey appearance.

The specific gravity of galena is 7·5 to 7·8, and its composition, when absolutely pure, is:—

Lead	86·55
Sulphur	13·45
	100·00

Galena is, however, but seldom found chemically pure, as, in addition to variable quantities of earthy impurities, it almost always contains a certain amount of silver. It is usually observed that galena presenting large facettes is less argentiferous than those varieties having a closer grain, and thus finely granular steely specimens generally afford the largest amount of silver.

It would appear, from recent experiments, that the silver contained in the finely-granular varieties of galena often occurs in the form of sulphide of silver, mechanically intermixed, whilst in the more flakey descriptions of this ore, the sulphides of lead and silver are chemically combined.

Galena occurs in beds and veins, in granite, gneiss, clay-slate, limestone, and sandstone rocks.

In Spain it is found in the granite hills of Linares and elsewhere, at Frieberg in Saxony, it occupies veins in gneiss, in the Harz, Bohemia, Cornwall, and many other localities, it is found in killas, or clay-slate. The rich deposits of Derbyshire, Cumberland, and the northern districts of England are in the mountain limestone, whilst at Commern, near Aix-la-Chapelle, large quantities of this ore are found disseminated in the Bunter sandstone.

This mineral is frequently associated with blend, iron and copper pyrites, the carbonate and other ores of lead, and usually occurs in a gangue of sulphate of baryta, calc-spar, spathose iron, or quartz. It is also not unfrequently associated with fluor-spar.

The next most important ore of lead is the carbonate, which is a brittle mineral, of a white or greyish-white colour, having a specific gravity varying from 6·46 to 6·50. Its composition is,—

Carbonic acid	16·05
Oxide of lead	83·56
	99·61

Large quantities of this substance occur in the mines of the Mississippi Valley, in the United States of America, where they were formerly thrown away as useless, but have since been collected and smelted. Vast deposits of this substance have also been found in the Bunter sandstone, near Düren, in Prussia, and at Freyung, in Bavaria. In the two latter localities it appears to form the cement holding together the granules of quartz, of which the sandstone principally consists. These ores, which yield from 14 to 20 per cent. of metal, do not readily admit of being concentrated by washing.

The sulphate of lead does not often occur in sufficient quantities to be employed as an ore of that metal. In appearance it is not unlike the carbonate, but may readily be distinguished from it by its not dissolving with effervescence in nitric acid.

Its specific gravity is from 6·25 to 6.30, and its composition—

Sulphuric acid	25·65
Oxide of lead	74·05
	99·70

This ore of lead usually results from the oxidation of galena. At St. Martin's, near the Vega de Ribaddeo, in Spain, this mineral, more or less mixed with the phosphate of lead, is found in sufficient quantities to be made, on a small scale, the subject of an especial metallurgic treatment. Large quantities of sulphate of lead ores are also annually imported into this country from the mines in Australia. These ores contain on an average 35 per cent. of lead and 35oz. of silver to the ton of ore, together with a little gold.

Phosphate of lead, when crystallised, usually presents the appearance of hexagonal prisms, of a bright-green, brown, or yellowish colour. Its specific gravity varies from 6·5 to 7·1. This mineral is composed of a mixture of true phosphate of lead, phosphate of lime, chloride of lead, and fluoride of calcium, and usually contains about 78 per cent. of oxide of lead. In Spain, it occurs in botryoidal forms, in connexion with the sulphate of the same metal, and is treated in blast furnaces for the lead it affords.

The other minerals containing lead seldom occur in sufficient quantities to be of much importance to the smelter, and may therefore be disregarded in the present paper.

The extraction and mechanical preparation of ores is the business of the miner, and not of the metallurgist, who receives the ores from the former freed as perfectly as possible from foreign matters.

The metallurgic processes, by the aid of which lead is obtained from galena, may be divided into two classes. The first of these is founded on the following reactions:—If one equivalent of sulphide of lead and two equivalents of the oxide of the same metal are fused together, the result is three equivalents of metallic lead and one equivalent of sulphurous acid, which is evolved.

This reaction is represented by the following equation:

$$\mathrm{PbS} + 2\mathrm{PbO} = 3\mathrm{Pb} + \mathrm{SO}^{2}.$$

When, on the other hand, one equivalent of sulphide of lead and one equivalent of sulphate of lead are similarly treated, two equivalents of lead are obtained, and two equivalents of sulphurous acid gas evolved. Thus,

$$\mathrm{PbS} + \mathrm{PbO},\ \mathrm{SO}^{3} = 2\mathrm{Pb} + 2\mathrm{SO}^{2}.$$

The process, founded on the foregoing reactions, and which we will distinguish as the *method by double decomposition*, consists in roasting the galena in a reverberatory furnace until a certain amount of oxide and sulphate has been formed, and subsequently, after having intimately mixed the charge, and closed the doors of the furnace, causing the whole to enter into a state of fusion.

During this second stage of the operation, the reaction between the sulphides, sulphates, and oxides takes place, and metallic lead is eliminated. The roasting of the ore is, in some cases, conducted in the same furnace in which the fusion is effected, whilst in others two separate furnaces are employed.

The process by double decomposition is best adapted for the richer varieties of ore, and such as are least contaminated by siliceous or earthy impurities, and is consequently that which is almost universally employed for smelting the ores of this country.

By the second method which we will call the *process by affinity*, the ore is fused with a mixture of metallic iron, which by combining with the sulphur, liberates the metallic lead. This reaction will be understood by reference to the following formula:—

$$\mathrm{PbS} + \mathrm{Fe} = \mathrm{Pb} + \mathrm{FeS}.$$

In practice, however, metallic iron is not always employed for this purpose; cast-iron is also frequently used, and in some instances the ores of iron and hammer slags are substituted, as are also tap-cinder and other secondary products containing a considerable per centage of this metal. None of these substances are, however, found to be so efficacious as metallic iron, since cast-iron requires to be decarburised before it can readily decompose the sulphide of lead, and the ores of iron require the introduction of various fluxes, and the consequent expenditure of an additional amount of fuel. In all cases, however, it is judicious to subject the ore to a preliminary roasting, in order to eliminate a portion of the sulphur, and thereby reduce the expenditure of iron, as well as to agglutinate the ore and render it better adapted for its subsequent treatment in the blast furnace.

I will not attempt to describe the different forms given to roasting furnaces employed for the ores treated by this process, but would remark that they frequently resemble the kilns used for the preparation of lime, whilst in some instances the ores are roasted in heaps interstratified with wood or other fuel.

The method of treating ore by *affinity* is particularly adapted to those varieties that contain a considerable amount of silica, since such minerals, if treated by double decomposition, would, by the formation of oxide of lead, give rise to silicates, from which it would be exceedingly difficult to extract the metal.

English Process.—Treatment by Double Decomposition.—Galena, if placed in a close vessel which protects it from the action of the air, and exposed to a gradually increasing temperature, becomes fused without the elimination of any lead taking place, but ultimately a portion of the sulphur is driven off, and a subsulphide is formed, which at a very elevated temperature is volatilised without change.

If, however, the vessel be uncovered, and the air allowed to act on its contents, oxygen combines with the sulphur, sulphurous acid is evolved, and the desulphuration of the mineral is slowly effected.

When galena is spread on the hearth of a reverberatory furnace, and is so placed as to present the largest possible amount of surface to oxidising influences, it will be found that the surface slowly becomes covered with a yellowish-white crust of sulphate of lead. The oxygen of the air, by combining with the two elementary bodies of which galena is composed, will evidently produce this effect. This is not, however, the only chemical change which takes place in the charge under these circumstances; oxide of lead is produced at the same time as the sulphate, or rather the formation of the oxide is prior to that of the sulphate.

In fact, during the first stage of the operation of roasting, sulphurous acid is evolved, the sulphur quits the lead, and a portion of that metal remains in a free state. This becomes oxidised by the air passing through the furnace, and subsequently a part of it combines with sulphuric acid, formed by the oxidation of sulphurous acid, and sulphate of lead is the result. In this way, after the expiration of a certain period, both oxide and sulphate of lead are present in the furnace.

During the early period of the roasting, when the temperature of the furnace is not very elevated, the proportion of sulphate is larger than that of the oxide formed, but in proportion as the heat of the apparatus increases, the production of oxide becomes more considerable, whilst that of the sulphate diminishes.

The sulphate and oxide thus formed re-act in their turn on the undecomposed galena, whilst a portion of the latter, by combining with the sulphide of lead, gives rise to the formation of oxysulphides.

This last compound has no action on galena, except to dissolve it in certain proportions, but is readily decomposed by the aid of carbonaceous matters.

It is therefore evident that the addition of carbon, at this stage of the operation, will have the effect of reducing the oxide and oxysulphide of lead.

Every process then that has for its object the reduction of lead ores by double decomposition, comprises two principal operations. 1st. The reduction of galena, by the aid of heat and atmospheric air, to a mixture of sulphide, oxide, and sulphate, which mutually decompose each other with the elimination of metallic lead. 2nd. The reduction of the oxysulphide by the addition of carbonaceous matter.

The Reverberatory Furnace.—The reverberatory furnace employed for the treatment of galena is composed, like all other furnaces of this description, of three distinct parts, the fire-place, the hearth, and the chimney.

The hearth has to a certain extent the form of a funnel, of which the lowest point is on the front side of the furnace immediately below the middle door. The molten metal descending from every side along the inclined bottom or sole, is collected in this receptacle, and is ultimately run off by means of a proper tap-hole. This tap-hole is, during the operation, closed by a pellet of clay.

The inclination of the hearth is more rapid in the vicinity of the fire-bridge than towards the chimney, in order that the liquid metal may not be too long exposed to the oxidising and volatilising influences of a current of strongly-heated air.

The dimensions given to these furnaces, as well as the weight of the charge operated on at one time, vary considerably in different localities, but in the north of England the following measurements are usually employed: The fire grate is 5ft. 9in. × 1ft. 10in., and the thickness of the fire-bridge 1ft. 6in.; the length of the sole is 9ft., and its average width 7ft. The depth of the tap is about 2ft. 6in. below the top of the inclined sole. The height of the roof at the fire-end may be 1ft. 4in., and at the other extremity 11 inches.

The introduction of the charge is in some cases effected by the doors of the furnace, whilst in other instances a hopper, placed over the centre of the arch, is made use of.

On the two sides of the furnace are placed three doors about 11in. × 9in., which are distinguished as 1, 2 and 3, counting from the fire-bridge end. The three doors on the one side are known as the front-doors, whilst those on the other side are called the back-doors. Immediately beneath the door on the front side of the furnace is situated the iron pan into which the molten lead is tapped off.

The bottom of this arrangement is in most cases composed of fire-bricks, covered by a layer of vitrified slags, of greater or less thickness. In order to form this bottom, the slags are introduced into the furnace, the doors closed, and the damper raised. An elevated temperature is thus quickly obtained, and as soon as the scoriæ have become sufficiently fused, they are, by means of rakes and paddles, made to assume the required form. The charge employed, as before stated, varies in almost every establishment. In the North, however, smaller charges are used than most other localities. At Newcastle, and in the neighbourhood, the charge varies from 12 to 14 cwt.; in Wales, and near Bristol, 21 cwt. charges are treated; whilst in Cornwall, charges of 30 cwt. are not unfrequently worked. The time required for smelting a charge varies with its weight and the nature of the ores, from 6 to 24 hours.

In some cases the ore is introduced raw into the furnace, whilst in others it undergoes a preliminary roasting previous to its introduction. Rich ores are generally smelted without being first calcined, but the poorer varieties, and particularly those which contain large quantities of iron pyrites, are, in most instances, subjected to roasting in a separate furnace.

In order to understand more clearly the operation of smelting in furnaces of this description, we will suppose that a charge has just been tapped off, and that, after thoroughly clearing the hearth, a fresh charge of raw ores has been introduced. During the first part of the operation of roasting, which usually occupies about two hours, the doors are taken off to admit free access of air, and also for the purpose of cooling the furnace, which has been strongly heated at the close of the preceding operation. No fuel is at this period charged upon the grate, since the heat of the furnace is of itself sufficient to effect the elimination of the first portions of sulphur. The ore is carefully stirred, for the purpose of constantly presenting a fresh surface to oxidising influences, and when white fumes are no longer observed to pass off in large quantities, a little coal may be thrown on the grate, and the temperature gradually elevated until the charge becomes slightly clammy and adheres to the rake. When the roasting is considered as being sufficiently advanced, the smelter turns his attention to the state of the fire, taking care to remove the clinkers and get the grate into proper condition for the reception of a fresh supply of fuel. The furnace doors are now closed, and a strong heat is kept up for about a quarter of an hour, when the smelter examines the condition of his charge by removing one of the doors. If the operation is progressing satisfactorily, and the lead flowing freely and passing without obstruction into the tap, the firing is continued a little longer; but when the ores have been found to have taken fire, or are lying unevenly on the bottom of the furnace, the position of the charge is changed by the use of an iron paddle. During this operation the furnace becomes partially cooled, and the reduction of temperature thus obtained is frequently found to produce decompositions, which facilitate the reduction of the charge. In the case of extremely refractory ores this alternate heating and cooling of the furnace is sometimes almost indispensable, whilst, in other instances, their being raked over once or twice, is all the manipulation that is required.

We will suppose that four hours have now elapsed since the charging of the furnace, and that the charge has run down the inclined sole towards the tap. The smelter now examines the condition of the scoriæ and adds a couple of shovelfuls of lime and three or four shovelfuls of small coals, the amount and relative proportions of these being regulated in accordance with the aspect of the slags. The charge is now, by means of proper tools, again raised to the breast of the furnace, and the firing continued until the charge has run down into the tap hole. The foreman now takes his rake and feels if any lumps remain in an unfused condition, and if he finds all to be in a fluid state he calls his assistant from the other side, and, by the addition of a small quantity of lime and fine coal, makes the slag assume a pasty or rather doughy consistency. By the aid of his paddle he now pushes this compound up to the opposite side of the furnace, where it is drawn by an assistant through the back door into a trough containing water. Whilst the assistant is doing this the foreman is busily engaged in tapping off the metal into the iron pan in front of the furnace, from which, when sufficiently cooled, it is laded out into suitable moulds.

The total duration of the operation may be about six hours.

To build a furnace of the above description, 5,000 common bricks, 2,000 fire bricks, and 2½ tons of fire-clay are required. In addition to this must be reckoned the iron-work, the expense of which will be much influenced by the nature of the armatures employed and the locality in which the furnace is constructed.

The amount of fuel employed for the treatment of a ton of lead ore varies not only in relation to the richness of the mineral, but is also much influenced by the nature of the associated matrix and the calorific value of the fuel itself. The loss of metal experienced during the operation is mainly dependent on the richness of the ore treated and the skill and attention of the foreman.

In the North about 12 cwt. of coal are consumed in the elaboration of one ton of ore, and the loss of metal on 60 per cent. ore may be estimated at about 12 per cent., of which about 6½ per cent. is subsequently recovered from the slag and fumes. At a well-conducted smelting works, situated in the west of England, in which the average assay of the ores smelted during the year was 75½, the yield from the smelting furnaces was 68½ per cent., and the coal used per ton of ore was 13¾ cwts. The lead recovered from the slag and fumes amounted to 2¾ per cent., making the total yield of metal 71¼ per cent., and the loss on the assay produce 4½ per cent.

In this establishment the men are paid from 7s. 6d. to 12s. 6d. per ton of lead, in accordance with the nature of the ores operated on.

In one establishment the process before described is somewhat varied. The charge employed is 21 cwt. This is run down and tapped off at the expiration of 6 hours, and about nine pigs of 1¼ cwt. each usually obtained. A second charge of 21 cwt. is then dopped in, and, as soon as it is roasted, mixed with the slags of the former operation. The whole is then run down in the ordinary way, the slags drawn and the lead tapped off in nine hours. The produce of the second or double charge is from 14 to 15 pigs.

If the ores are difficult to flow, 16 to 16½ hours are required for the two charges. A small quantity of black slag from the slag hearth is employed for drying up.

Slag Hearth.—The various slags obtained from the different operations of lead smelting are divided into two classes. Those which do not contain a sufficient amount of metal to pay for further treatment are thrown away as useless, whilst those in which the per centage of lead is sufficiently large are treated by the slag hearth.

This consists of a small blast-furnace, having the form of a rectangular prism, about 25 inches in length, 22 inches in breadth, and 33 inches in height. The bottom is composed of a thick cast-iron pan, which is made to incline slightly from the tuyere towards the breast of the furnace. Cast-iron bearers are placed on each side of the iron plate, and on these is supported the fore-hearth, which consists of two stout plates of cast iron. A space of about 5 inches is thus left between the front and bottom of the furnace and an additional height of 2½ inches is obtained by placing between them a row of fire-bricks laid on their flat.

The slags escaping through the opening in the breast of this arrangement sometimes flow into a cistern of water sunk in the earth. This causes the slags to divide into small fragments, and thus adapts them for the process of washing, when it is intended to subject them to this operation. Before starting a furnace of this description, its bottom is filled to a depth of a foot or fifteen inches with small spongy cinders rather closely packed together, and which reach to within four or five inches of the orifice of the tuyere; the breast pan is also filled with cinders which are intended to act as a kind of filter in the separation of metallic lead from the slags. The furnace is frequently lighted by the aid of a small quantity of peat, and when this has become fairly ignited, some good hard coke is thrown in, and as soon as it appears to be sufficiently inflamed, a stratum of grey slag or any other substance to be treated, is introduced. From this time, the hearth is supplied with alternate strata of fuel and slag. The lead obtained from the slag hearth is, from the high temperature at which it is produced, always harder, and therefore inferior in quality to that procured directly from the ores in the reverberatory furnace, and this process is consequently never applied to the treatment of products that admit of being economically worked by the furnace before described.

In addition to being employed for the reduction of slags, this apparatus is sometimes applied to the elaboration of ores of low produce, in the treatment of which the object sought is rather the extraction of the silver they contain, than the reduction of the largest possible amount of lead.

Instead of being blown by a cold blast, these furnaces are sometimes supplied with heated air. When smelting with cold air, it is often found difficult to proportion the quantity of slag or other substance operated on, so as to preserve the nose or cone of slag which forms at the end of the tuyere from growing too long, to the prejudice of the operation. When the substance operated on is poor for metal, and very refractory, it frequently happens that the smelter is obliged to break the nose, or introduce some very fusible substance in order to melt it off. By the introduction of hot air this inconvenience is removed, since by increasing or lowering the temperature of the blast, the nose may be allowed to lengthen or shorten, according as the nature of the slags may require. The temperature found to answer best is from 250° to 300° Fahr.; since when it is heated to from 500° to 600°, it is found impossible to form a nose of sufficient length to convey the blast to the front of the hearth and therefore the back, which is expensive to rebuild, is quickly destroyed.

The advantage to be derived from the use of the hot blast will be evident, from the result of two experiments which were tried some years since.

Twenty-eight tons of slag smelted with cold blast consumed 392 cubic feet of air per minute.

Labour cost	£3	7	8
Coke, 7 tons, at 24s. 6d.........	8	11	6
Total	£11	19	2

Thirty-five tons of similar slag smelted with hot blast consumed 300 cubic feet of air per minute.

Labour cost	£3	7	8
Coke, 5 tons, 17 cwt., at 24s. 6d............	7	3	4
Turf for heating air, 11 loads, 1s. 8d...	0	18	4
Total	£11	9	4

From which it will be seen that, with one-quarter part less air, a quarter part more slag was melted per week, and a saving in expense of 10s. effected.

The loss of lead experienced in smelting by the slag hearth, is, however, very great, even under the most favourable circumstances; and it has consequently, of later years, been gradually superseded by the Castillian furnace, which will be shortly described. Many large and well-conducted establishments still however continue to employ the slag hearth, and, when well constructed and skilfully managed, the loss arising from volatilisation may be considerably reduced.

Scotch Hearth.—Instead of the reverberatory furnace, the Scotch hearth may frequently be employed with advantage for the treatment of lead ores of a good produce. This consists of a rectangular cavity, lined with cast-iron, and of which the dimensions vary in different localities, although it is frequently made about 2ft. square.

The bottom is also of cast-iron, and is surrounded by a ledge about five inches in height, with the exception of the side nearest the work-stone, which is of iron, and may be about 20 inches in breadth. This plate is made to have a fall of about six inches on its whole breadth; its upper side rests on the hearth bottom, or in some instances is united with it, only forming one casting. On the back edge of the furnace bottom is placed a prism of cast-iron, called a back-stone, and on this rests the nozzle of the tuyere, over which is again placed another block of the same metal, called a pipe-stone, and on this again is placed another back-stone, which completes this side of the hearth. Along the two lateral edges of the hearth-bottom are laid two prismatic castings, called bearers, which project slightly over the upper edge of the work-stone. Above these bearers is a prism of cast-iron called a fire-stone, the space at each end being closed by cubes of cast-iron called key-stones.

Before the work-stone, and set in masonry, is the lead-pot, into which the melted metal as it issues from the hearth, is conducted by an oblique channel sunk beneath the surface of the iron plate. To prevent the escape of fumes into the smelting-house, the whole is covered by a hood of arched bricks, which is provided with a sheet-iron front. The blast introduced through the tuyere is regulated by a throttle-valve, and the brick-work is consolidated and bound together by heavy iron straps, kept in their places by screw-bolts passing through the masonry. The ores treated in the Scotch hearth are usually roasted in a separate furnace, for the purpose of effecting their partial desulphuration and oxidation before undergoing the process of smelting.

At the termination of every shift, a quantity of ore remains on the hearth in a semi-reduced state called browse, and is more or less mixed with fragments of coke and clinker, from which it is afterwards roughly separated.

To commence a new shift, the cavity of the furnace is filled with peat cut into blocks; those at the back are heaped up without any kind of order, but those towards the front are arranged in the shape of a wall. The blast is now turned on, and an ignited fragment of peat thrown immediately before the nozzle, which quickly communicates combustion to the whole mass. On the top of this a few shovelfuls of coal are subsequently placed, and the browse resulting from the preceding operation is then charged on the top of the ignited mass, and shortly afterwards a portion of the molten matter in the internal basin is drawn on to the work-stone. The grey slag is now removed, and thrown on one side of the furnace, and the browse, thus freed from slag, again returned to the hearth, with the addition of a little coal. If, as is sometimes the case, it has not been properly freed from slag, and therefore exhibits a disposition to fuse, it must be hardened by the addition of a small quantity of quicklime, which dries up the materials in such a way as to facilitate the subsequent extraction of the lead. When, on the contrary, the ore is found too refractory, a small quantity of lime, or of lime and fluor-spar is added, but in this case a less amount of lime is employed, as it is intended as a flux and not as a drier of a too fusible slag. The slag thus obtained still contains a notable amount of lead, and is subsequently treated in the slag hearth.

When the whole of the browse has been thrown back into the hearth, a few shovelfuls of roasted ore are distributed over it; before doing this, however, the scoriæ are removed, and a lump of peat is placed before the tuyere, which not only prevents any of the mineral from entering the nozzle, but also from its porosity, seems to equalise and distribute the air through the mass.

After another interval of about twenty minutes, the contents of the hearth are again drawn out on the work-stone, and another portion of metallic lead obtained. The grey slag is removed, and another lump of peat placed before the tuyere; the browse, together with a proper quantity of coal and quick lime, is again thrown upon the fire, and on the top is laid a fresh supply of roasted ore. The Scotch hearth will, in accordance with the nature of the ore treated, yield from one to two tons of metallic lead per shift, and usually affords softer metal than the reverberatory furnace.

In an establishment in the North, where the Scotch hearth is employed, and in which the ores treated contain on an average 73 per cent. of metal, the following results are obtained:—

The lead reduced at the first fire amounts to 60 per cent., but 3·20 per cent. are subsequently obtained from the slags, and 6·91 per cent. from the fumes, making the ultimate loss on the assay produce 2·90 per cent.

The materials employed for the elaboration of one ton of ore are as follows:—

	cwt.	qrs.	lbs.	cwt.	qrs.	lbs.
Coals for smelting	1	2	4	3	1	15
,, ,, calcining	1	3	11			
Peat or turf, ...				0	3	0
Lime				0	2	0
Total				4	2	15

To construct an ore hearth 2,000 common bricks, and the same quantity of fire-bricks are required, together with about 1½ tons of fire clay.

Castillian Furnaces.—Within the last few years a blast furnace has been introduced into the lead works of this country, which possesses great advantages over every other description of apparatus which has been hitherto employed for the treatment of lead ores of low produce. This apparatus, although first employed in Spain, was I am informed, invented by an Englishman (Mr. W. Goundry) who was employed in the reduction of rich slags in the neighbourhood of Carthagena.

This furnace is circular, usually about 2 feet 10 inches, or 3 feet in diameter, and is constructed of the best fire-bricks, so moulded as to fit together, and allow all the joints to follow the radii of the circle described by the brick work. Its usual height is 8 feet 6 inches, and the thickness of the masonry invariably 9 inches. In this arrangement the breast is formed by a semi-circular plate of cast-iron, furnished with a lip for running off the slag, and has a longitudinal slot, in which is placed the tapping-hole.

On the top of this cylinder of brickwork a box-shaped covering of masonry is supported by a cast-iron framing, resting on four pillars, and in this is placed the door for feeding the furnace, and the outlet by which the various products of combustion escape to the flues. The lower part of this hood is fitted closely to the body of the furnace, whilst its top is closed by an arch of 4½ inch brickwork laid in fire-clay. The bottom is composed of a mixture of coke-dust and fire-clay, slightly moistened, and well-beaten to the height of the top of the breast-pan, which stands nearly 3 feet above the level of the floor. Above the breast-pan is an arch, so turned as to form a sort of niche, 18 inches in width, and rather more than 2 feet in height.

When the bottom has been solidly beaten, up to the required height, it is hollowed out so as to form an internal cavity, communicating freely with the breast-pan, which is filled with the same material and subsequently hollowed out to a depth slightly below the level of the internal cavity. The blast is supplied by three water tuyeres, 3 inches in diameter at the smaller end, 5½ inches at the larger, and 10 inches in length. Into these the nozzles are introduced, by which a current of air is supplied by means of a fan or ventilator, making about 800 revolutions per minute. The blast may be conveniently conducted to the nozzle through brick channels formed beneath the floor of the smelting house.

The ores treated in this furnace ought never to contain more than 30 per cent. of metal, and when richer, must be reduced to about this tenure by the addition of slags and other fluxes. In charging this apparatus, the coke and ore are supplied stratum super stratum, and care must be taken so to dispose the coke as not to heat too violently the brickwork of the furnaces.

In order to allow the slags which are produced to escape freely into the breast-pan, a brick is left out of the front of the furnace at the height of the fore-hearth, which, for the purpose of preventing the cooling of the scoriæ, is kept covered by a layer of coke-dust or cinders. From the breast-pan the slags flow constantly off over a spout into cast-iron waggons, where they consolidate into masses, having the form of truncated pyramids, of which the larger base is about 2 feet square. As soon as a sufficient amount of lead has accumulated in the bottom of the furnace, it is let off into a lateral lead pot, by removing the clay-stopper of the tap hole situated in the slot of the breast-pan, and after being properly skimmed it is laded into moulds. When in addition to lead the ore treated likewise contains a certain portion of copper, this metal will be found in the form of a matt floating on the surface of the leaden bath. This, when sufficiently solidified, is removed, and after being roasted is operated on for the copper it contains.

The waggons in which the liquid slag runs off, are frequently made to traverse small railways by which, when one mass has been removed, its place may readily be supplied by an empty waggon. When nearly cold the casings of the waggons are turned over and the blocks of slag easily made to drop out. In addition to the facility for transport obtained in this way, one of the great advantages obtained by this method of manipulation arises from the circumstance that should the furnaces at any time run lead or matt, without its being detected by the smelter, the whole of it will be collected at the bottom of the block, from which, when cold, it may be readily detached.

In working these furnaces, care must be taken to prevent flame from appearing at the tunnel-head, since, provided the slags are sufficiently liquid, the cooler the apparatus is kept the less will be the loss of metal through volatilisation. In addition to the greatest attention being paid to the working of the furnace, it is necessary, in order to obtain the best results, that all establishments in which this apparatus is employed should be provided with long and capacious flues, in which the condensation of the fumes takes place, previous to arriving at the chimney-shaft. These flues should be built three feet in width, and six feet in height, so as readily to admit of being cleaned, and are often made of several hundred feet in length. The value of the fumes, so condensed, amounts to many hundreds, and in some instances thousands per annum.

In order to be advantageously worked in these furnaces, the ores should be first roasted, and subsequently agglomerated into masses, which, after being broken into fragments, of about the size of the fist, and mixed with the various fluxes, are charged as before described.

In an establishment in which the average assay produce of the roasted ore for lead is $42\frac{4}{5}$ths, the furnace yield is $38\frac{13}{14}$ths, and the weight of coke employed to effect the reduction 22 per cent. of the roasted ore operated on. The mixture charged into the furnace, in this instance, is composed of 100 parts of roasted ore, 42 parts of slags, from a previous operation, 8 parts of scrap iron, and 7 parts of limestone. Each furnace works off about seven tons of roasted ore in the course of 24 hours; the weight of slags run off is about double that of the lead obtained, and the matt removed from the surface of the pan is nearly 5 per cent. of the lead produced. The ores treated in this establishment consist of galena, much mixed with spathose iron, and are therefore somewhat refractory. A furnace of this kind requires for its construction about 1,200 segmental fire-bricks, and the same number of ordinary fire-bricks of second quality.

The desulphuration of the ores to be treated in these furnaces may be effected either by the aid of an ordinary reverberatory roasting furnace, or in heaps, or properly constructed kilns.

The kilns best adapted for this purpose consist of rectangular chambers having an arched roof, and provided with proper flues for the escape of the evolved gases, as well as a wide door for charging and withdrawing the ore to be operated on.

Each of these chambers is capable of containing from 25 to 30 tons of ore, and in order to charge it a layer of faggots and split wood is laid on the floor, and this, after having been covered by a layer of ore, about two feet in thickness, is ignited, care being, at the same time, taken to close, by means of loose brick-work, the opening of the door to the same height. When this first layer has become sufficiently ignited, a fresh stratum of ore, mixed with a little coal or charcoal, is thrown upon it, and when this layer has in its turn, become sufficiently heated, more ore is thrown on. In this way more ore is every day added, until the kiln has become full, when the orifice of the doorway is closed by an iron plate, and the operation proceeds regularly and without further trouble until the greater portion has become eliminated.

This usually happens at the expiration of about four weeks from the time of first ignition, and the brick-work front is then removed, and the ores broken out, and after being mixed with proper fluxes, passed through the blast furnace.

The proportion of wood necessary for the roasting of a ton of ore by this means must necessarily depend on the composition of the minerals operated on, but with ores of the description above-mentioned, and in a neighbourhood where wood is moderately cheap, the desulphuration may be effected at a cost of about 5s. per ton.

Calcining.—The lead obtained by the various processes above described generally contains a sufficient amount of silver to render its extraction of much importance; but, in addition to this, it is not unfrequently associated with antimony, tin, copper, and various other impurities, which require to be removed before the separation of the silver can be effected.

This operation consists in fusing the hard lead in a reverberatory furnace of peculiar construction, and allowing it to remain, when in a melted state, exposed to the oxidising influences of the gases passing through the apparatus. By this treatment the antimony, copper, and other impurities become oxidised, and on rising to the surface of the metallic bath are skimmed off, and removed with an iron rake. The hearth of the furnace in which this operation is conducted consists of a large cast-iron pan, which may be 8 feet in length, 5 feet 6 inches in width, and 10 inches in depth. The fire-place, which is 1 foot 8 inches in width, has a length equal to the width of the pan, and is separated from it by a fire-bridge 2 feet in width. The height of the arch at the bridge end is 1 foot 4 inches above the edge of the pan, whilst at the outer extremity it is only about 8 inches.

The lead to be introduced into the pan is first fused in a large iron pot fixed in brick-work at the side of the furnace, and subsequently ladled into it through an iron gutter adapted for that purpose. The length of time necessary for the purification of hard lead obviously depends on the nature and amount of the impurities which it contains; and, consequently, some varieties will be sufficiently improved at the expiration of twelve hours, whilst in other instances it is necessary to continue the operations during three or four weeks. The charge of hard lead varies from eight to eleven tons.

When the metal is thought to be in a fit state for tapping, a small portion taken out with a ladle, and poured into a mould used for this purpose is found on cooling to assume at the surface a peculiar crystallised appearance, which when once seen is readily again recognised. As soon as this appearance presents itself an iron plug is withdrawn from the bottom of the pan, and the lead run off into an iron pan, from which it is subsequently laded into moulds.

The items of cost attending the calcination of one ton of hard Spanish lead in the north of England are about as follows:—

	s.	d.
Wages	1	11·2
Coals 2·7 cwt		4·7
Repairs, &c	1	0·5
	3	4·4

The construction of a furnace of this description requires 5000 common bricks, 3,500 fire-bricks, and 2 tons of fire clay.

Concentration of the Silver.—This process is founded on the circumstance first noticed in the year 1829, by the late H. L. Pattinson of Newcastle-on-Tyne, that when lead containing silver is melted in a suitable vessel, afterwards slowly allowed to cool, and at the same time kept constantly stirred, at a certain temperature near the melting point of lead metallic crystals begin to form. These as rapidly as they are produced, sink to the bottom, and on being removed are found to contain much less silver than the lead originally operated on. The still fluid portion, from which the crystals have been removed, will at the same time be proportionally enriched.

This operation is conducted in a series of eight or ten cast-iron pots, set in a row, with fire-places beneath. These are each capable of containing about 6 tons of calcined lead; and on commencing an operation that quantity of metal, containing, we will suppose 20 oz. of silver per ton, is introduced into a pot (say No. 4) about the centre of the series. This, when melted, is carefully skimmed with a perforated ladle, and the fire immediately withdrawn. The cooling of the metal is also frequently hastened by throwing water upon its surface, and whilst cooling it is kept constantly agitated by means of a long iron stirrer or slice. Crystals soon begin to make their appearance, and these as they accumulate and fall to the bottom are removed by means of a large perforated ladle, in which they are well shaken, and afterwards carried over to the next pot to the left of the workman. This operation goes on continually until about 4 tons of crystals have been taken out of the pot No. 4, and have been placed into pot No. 5, at which time the pot No. 4 may contain about 40 oz. of silver to the ton, whilst that in No. 5 will only yield 10 oz. The rich lead in No. 4 is then laded into the next pot No. 3, to the right of the workman, and the operation repeated in No. 4, on a fresh quantity of calcined lead.

In this way calcined lead is constantly introduced, and the resulting poor lead passes continually to the left of the workman, whilst the rich is passing towards his right. Each pot in succession, when filled with lead of its proper produce for silver, is in its turn crystallised, the poor lead passing to the left of the workman, and the enriched lead to his right. By this method of treatment it is evident that the crystals obtained from the pots to the left of the workman must gradually be deprived of their silver, whilst the rich lead passing to his right becomes continually richer. The final result is, that at one end of the series, the poor lead contains very little silver, whilst at the other an exceedingly rich alloy of lead and silver is obtained.

The poor lead obtained by this process should never contain more than 12 dwts. of silver per ton, whilst the rich lead is frequently concentrated to 500 oz. to the ton. This rich lead is subsequently cupelled in the refining furnace.

The ladle employed for the removal of the crystals, when manual labour is made use of, is about 16 inches in diameter, and 5 inches in depth, but when cranes are used much larger ladles are easily managed. A form of crane has been invented by Mr. J. Sparks, which effects considerable economy of labour. When, during the operation of crystallisation, the ladle becomes chilled it is dipped into a small vessel containing lead of a higher temperature than that which is being worked, and known by the name of a temper-pot. The pot containing the rich lead is often called the No. 1 pot; in some establishments, however, the last pot in which the pure lead is crystallised obtains this appellation.

The cost of crystallising one ton of calcined Spanish lead, in the establishment quoted when treating of calcination, is as follows:—

	s.	d.
Wages	9	5·4
Coals, 4 cwts.	0	8·4
Repairs	0	2·5
Total	10	4·3

The erection of nine six-ton pots requires 15,000 common bricks, 10,000 fire-bricks, 160 feet of quarles, 80 fire-clay blocks, and 5 tons of fire-clay.

In some establishments ten-ton pots are employed, and where cranes are made use of they are found to be advantageous.

Refining.—The extraction of the silver contained in the rich lead is conducted in a cupel forming the bottom of a reverberatory furnace called a refinery.

In this operation the litharge produced, instead of being absorbed by the substance of the cupel, is run off in a fluid state, by means of a depression called a gate.

The size of the fire-place varies with the other dimensions of the furnace, but is usually nearly square, and in an apparatus of ordinary size may be about 2 feet by 2 feet 6 inches. This is separated from the body of the furnace by a fire-bridge 18 inches in breadth, so that the flame and heated air pass directly over the surface of the cupel, and from thence escape by means of two separate apertures into the main flues of the establishment. The cupel or test consists of an oval iron ring, about 5 inches in depth, its greatest diameter being 4 feet, and its lesser nearly 3 feet. This frame, in order to better support the bottom of the cupel, is provided with cross-bars about 4½ inches wide, and one half inch in thickness. In order to make a test, this frame is beaten full of finely-powdered bone-ash, slightly moistened with water, containing a small quantity of pearl-ash in solution, which has the property of giving consistency to the cupel when heated.

The centre of the test, after the ring has been well-filled with this mixture, and solidly beaten down, is scooped out with a small trowel, until the sides are left 2 inches in thickness at top, and three inches at the bottom, whilst the thickness of the sole itself is about 1 inch.

At the fore part or wide end of the test the thickness of the border is increased to six inches, and a hole is then cut through the bottom, which communicates with the openings or gates by which the fluid litharge makes its escape.

The test, when thus prepared, is placed in the refinery furnace of which it forms the bottom, and is wedged to its proper height against an iron ring firmly built into the masonry. When this furnace is first lighted, it is necessary to apply the heat very gradually, since if the test were too strongly heated before it became perfectly dry, it would be liable to crack. As soon as the test has become thoroughly dry, it is heated to incipient redness, and is nearly filled with the rich lead to be operated on, which has been previously fused in an iron pot at the side of the furnace, and beneath which is a small grate where a fire is lighted.

The melted lead, when first introduced into the furnace, becomes covered with a greyish dross, but on further increasing the heat, the surface of the bath uncovers, and ordinary litharge begins to make its appearance.

The blast is now turned on, and forces the litharge from the back of the test up to the breast, where it passes over the gate, and falls through the aperture between the bone-ash and the ring into a small cast-iron pot running on wheels. The air, which is supplied by a small ventilator, not only sweeps the litharge from the surface of the lead towards the breast, but also supplies the oxygen necessary for its formation.

In proportion as the surface of the lead becomes depressed by its constant oxidation, and the continual removal of the resulting litharge, more metal is added from the melting pot, so as to raise it to its former level, and in this manner the operation is continued until the lead in the bottom of the test has become so enriched as to render it necessary that it should be tapped. The contents of the test are now so far reduced in volume that the whole of the silver contained in the rich lead operated on remains in combination with a few hundred weights only of metal, and this is removed by carefully drilling a hole in the bone-ash forming the bottom of the test. The reason for the removal of the rich lead, is to prevent too large an amount of silver from being carried off in the litharge, which is found to be the case when lead containing a very large amount of that metal is operated on.

When the rich lead has been thus removed, the tapping hole is again closed by a pellet of bone-ash, and another charge immediately introduced.

As soon as the whole of the rich lead has been subjected to cupellation, and has become thus further enriched, the argentiferous alloy is itself similarly treated, either in a fresh test, or in that employed for the concentration of the rich lead. The brightening of pure silver at the moment of the separation of the last traces of lead, indicates the precise period at which the operation should be terminated, and the blast is then turned off, and the fire removed from the grate. The silver is now allowed to set, and as soon as it has become hardened, the wedges are removed from beneath the test, which is placed on the floor of the establishment. When cold, the silver plate is detached from the test, and any adhering particles of bone-ash removed by the aid of a wire brush.

A test furnace of ordinary dimensions requires for its construction about 2,000 common bricks, 2,000 fire-bricks and 1½ tons of fire-clay. A furnace of this kind will work off 4 pigs of lead per hour, and consume 4 cwts. of coal per ton of rich lead ore operated on.

The cost of working a ton of rich lead in the neighbourhood of Newcastle, containing on an average 400 oz. of silver per ton, is as follows:—

	s.	d.
Refiner's wages	4	2·1
Coals 4 cwt	0	6·8
Engine wages	1	7·0
Coals 5 cwt	0	8·7
Pearl-ash	0	3·5
Bone-ash 17·3 lbs	3	1·0
Repairs	0	5·0
Total	10	10·1

Reducing.—The reduction to the metallic state of the litharge from the refinery, the pot dross, and the mixed metallic oxides from the calcining furnace is effected in a reverberatory apparatus, somewhat resembling a smelting furnace, except that its dimensions are smaller, and the sole, instead of being lowest immediately below the middle door, gradually slopes from the fire-bridge to near the flue, where there is a depression in which is inserted an iron gutter which constantly remains open and from which the reduced metal flows continuously into an iron pot placed by the side of the furnace for its reception, whence it is subsequently laded into moulds.

The litharge, or pot dross, is intimately mixed with a quantity of small coal, and is charged on that part of the hearth immediately before the fire-bridge. To prevent the fused oxide from attacking the bottom of the furnace, and also to provide a sort of hollow filter for the liquid metal, the sole is covered by a layer of bituminous coals.

The heat of the furnace quickly causes the ignition of this stratum, which is rapidly reduced to the state of a spongy cinder. The reducing gases present in the furnace, aided by the coal mixed with the charge itself, cause the reduction of the oxide, which, assuming the metallic form, flows through the interstices of the cinder, and ultimately finding its way into the depression at the extremity of the hearth, flows through the iron gutter into the external cast iron pot. The surface of the charge is frequently, during the process of elaboration, turned over with an iron rake, for the double purpose of exposing new surfaces to the action of the furnace, and also to allow the reduced lead to more readily flow off.

Fresh quantities of litharge or pot-dross, with small coals, are from time to time thrown in, in proportion as that already charged disappears, and at the end of the shift, which usually extends over 12 hours, the floor of cinder is broken up, and after being mixed with the residual matters in the furnace is withdrawn. A new floor of cinders is then introduced, and the operation commenced as before. A furnace of this kind, having a sole 8 feet in length and 5 feet in width, will afford, from litharge, about 4¼ tons of lead in 24 hours, and will consume 20 cwt. of coals.

The dross from the calcining pan, when treated in a furnace of this description, should be previously reduced to a state of fine division, and intimately mixed up with small coal and a soda-ash. In many cases, however, the calcined dross is treated in the smelting furnace. The hard lead obtained from this substance is again taken to the calcining furnace, for the purpose of being softened.

The expense of reducing one ton of litharge may be estimated as follows:—

	s.	d.
Wages	2	6·0
Coals (3 cwts.)	0	5·2
Repairs	0	1·6
Total	3	0·8

In the establishment from which the foregoing data were obtained, the cost of slack, delivered at the works, was only 2s. 11d. per ton, which is cheaper than fuel can be obtained in the majority of the lead-mills of the country. In North Wales the cost of small coal is generally about 4s., and at Bristol 5s. 6d. per ton.

The total cost of elaborating one ton of hard lead, containing 30 oz. of silver per ton, in a locality in which fuel is obtained at the low price above quoted, is nearly as follows:—

	£	s.	d.
Calcining	0	2	4·5
Crystallising	0	9	6·5
Refining	0	0	9·2
Reducing—pot dross and litharge	0	1	0·8
Calcined dross	0	0	8·0
Slags	0	0	5·0
Bone-ash, &c.	0	0	7·0
Transport, &c.	0	1	1·0
Management, taxes, and interest of plant	0	5	10·0
Total	£1	2	4·0

One hundred tons of hard lead treated gave—

	Tons.
Soft lead	94·90
Black dross	3·72
Loss	1·38
Total	100·00

On comparing the expense of each operation, as given in the foregoing abstract, with the amounts stated as the cost of each separate process, they will be found to be widely different, but it must be remembered that the whole of the substances elaborated are far from being subjected to the various treatments described.

In order therefore to give an idea of the relative proportions which are passed through the several departments, I may state that in an establishment in which the ores are treated in the Castillian furnace the following are the results obtained:—

One-hundred parts of raw ore yield:—	
Roasted ore	85
Hard lead	42
Soft "	36
Rich "	9
Dross and litharge re-treated	18½

The importance of this branch of our metallurgic industry will be gathered from the following tabular statements, chiefly derived from Mr. Hunt's valuable statistics:—

TABLE I.

Table showing the quantity of Lead Ore raised and smelted, average Metallic yield of Ore per cent., and Ratio of Lead produced in various parts of the United Kingdom during ten years ending 1857.

YEARS.	ENGLAND.		WALES.		IRELAND.		SCOTLAND.		ISLE OF MAN.		TOTAL.	
	Lead Ore.	Lead.	Lead Ore.	Lead.	Lead Ore.	Lead.	Lead Ore.	Lead.	Lead Ore.	Lead.	Lead Ore.	Lead.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1848	54,538	39,142	16,305	11,122	1,912	1,188	2,588	1,736	2,521	1,665	77,864	54,853
1849	60,124	41,168	19,711	13,389	2,739	1,653	1,421	957	2,826	1,535	86,821	58,702
1850	63,565	44,462	21,093	14,876	2,895	1,746	3,117	2,124	2,175	1,218	92,845	64,426
1851	64,102	45,103	19,314	14,813	3,222	1,829	3,113	2,140	2,560	1,402	92,311	65,287
1852	62,411	43,813	18,379	13,708	4,493	3,222	3,499	2,381	2,415	1,835	91,197	64,959
1853	59,342	41,897	17,131	12,870	3,309	2,452	2,799	1,919	2,460	1,829	85,041	60,967
1854	64,796	44,986	18,130	13,367	3,069	2,210	1,753	1,279	2,800	2,137	90,548	63,979
1855	66,270	46,244	18,206	13,673	2,405	1,732	1,587	1,159	3,573	2,725	92,041	65,533
1856	74,489	52,868	19,873	14,791	2,484	1,602	1,931	1,417	3,218	2,451	101,997	73,129
1857	68,520	48,356	21,455	16,124	2,299	1,407	1,891	1,351	2,656	2,028	96,821	69,266
	638,157	448,039	189,597	138,733	28,827	19,041	23,699	16,463	27,204	18,825	907,486	641,101
Average Metallic yield per cent. of Ore... ...	70·2		73·1		66·0		69·4		69·1		70·6	
Ratio of Lead produced ...	69·9		21·7		3·0		2·5		2·1		= 100	

TABLE II.

Estimated value of Lead and Silver consumed in Great Britain 1857.

Lead and Silver produced in the United Kingdom ...		£1,670,353
Silver imported, 846,569 oz.		232,806
		1,903,159
Lead exported..................	22,397 tons.	
,, imported	12,768 ,,	
Balance of exports	9,629...........................	211,838
Value consumed....................................		1,691,321

TABLE III.

Silver produced from Ores raised in Great Britain, during Four Years, ending 1857.

	1854.	1855.	1856.	1857.
	Ozs.	Ozs.	Ozs.	Ozs.
England	419,824	439,983	481,909	417,343
Wales	67,051	57,521	62,357	58,097
Ireland............	18,096	7,252	3,700	3,071
Scotland	5,426	4,947	5,289	4,206
Isle of Man............ ..	52,262	51,597	60,382	48,016
	562,659	561,300	613,637	530,733
Value at 5s. 6d. per oz....	£154,730	£154,357	£158,750	£146,501

Market Value of Lead produced in the United Kingdom in 1857..	£1,523,852
Ditto of Silver..	146,501
	£1,670,353

It would be evidently impossible to comprise within the limits of a single paper a description of the whole of the various processes employed in different parts of the world for the reduction of lead from its ores, and I have consequently confined myself to an exposition of the general routine of the operations commonly practised in this country.

In doing this it has been my endeavour to furnish reliable data as to the expenses and losses incurred in each operation, and although it would have been easy to have multiplied examples, want of space has prevented my doing so.

It is in the treatment of ores of good produce that the reverberatory furnace and Scotch hearth are to be preferred, but for working minerals of a low per centage the blast furnace may generally be substituted with advantage. The slag hearth, from the amount of fuel consumed and loss experienced, is a somewhat expensive apparatus, and might, in many cases, be advantageously exchanged for the Castillian furnace.

It is well-known that the losses which take place in this branch of metallurgy are, from the volatility of the metal operated on, unusually large. In those establishments, however, in which due attention is paid to fluxes and a proper admixture of ores, as well as the condensation of the fumes, a great economy is effected.

In lieu of long and extensive flues, condensers of various descriptions have from time to time been introduced, but in most instances the former have been found to be more efficient.

DISCUSSION.

The Chairman said, if he understood rightly the objects of the Society of Arts, he thought that such papers as the one brought before them that evening fully carried out its intention. Mr. Phillips had detailed to them the processes which were employed in the smelting of lead ores up to the latest improvements which had been introduced. Still it would be admitted by him, and he was sure it would be admitted by others familiar with the subject, that there remained great improvements to be made, for we were still suffering an enormous loss from the imperfections of even the best known processes. They might therefore hope that some gentlemen might be induced to offer some remarks upon these points, and the result might be the quickening of some dormant thought, which might lead to improvements in this branch of manufacture. He thought it would not be out of place to refer to one individual to whom we were specially indebted for much progress in this department of metallurgy. Mr. Phillips had referred to the process invented by Mr. Hugh Lee Pattinson for extracting the silver from lead ores. Within the last year that gentleman had been taken from them; and he thought this was a legitimate opportunity for acknowledging the debt of gratitude that we owed to him. He was in every respect a remarkable man. When a poor boy, in a small druggist's shop, in the little town of Alston, he taught himself chemistry, never having had an instructor. He was in every sense of the word a self-taught man; and he was a most industrious one, a most earnest worker, and a man of the closet and of the keenest powers of observation. He was led amongst other things, by seeing the process of lead smelting that was going on in his own immediate vicinity, to direct his attention to the means of separating the silver from the lead, and after making a series of experiments, he succeeded in producing a process which, for a long period of years, saved not less than 200,000 ounces of silver annually, which had previously been thrown away. Not only had this self-educated man effected this, but he had introduced another useful product from the lead ores, the oxy-chloride of lead, and had also given us a process for the preparation of the carbonate of magnesia from the dolomite, or magnesian limestone of the North of England. There was, however, nothing more remarkable in the career of this distinguished man than the way in which he bestowed the fortune which his industry secured to him, in promoting the best interests of those around him. In the neighbourhood of the works, now carried on by his family, he established schools, in which hundreds of workmen and children were educated. His was, therefore, a name, in connection with this subject, which he could not allow to pass without the brief comments which he had ventured to make.

Mr. Hyde Clarke, on being called upon by the Chairman, said he had not such a practical acquaintance with the various branches of metallurgy as Mr. Phillips possessed, and he had had very little to do with lead smelting. Mr. Phillips' observations, however, had tended very much to draw his attention to one subject which had been adverted to—viz., the importance of considering the operations of smelting as a whole, when working for the improvement of any particular process. It certainly was a great misfortune that in metallurgical pursuits too many practical men were absorbed in their own particular branch without studying the other branches; whereas in reality there were very few processes which, if carefully examined, would not be found capable of affording some hint for the improvement of other departments of metallurgy. It was a subject to which, he trusted, Mr. Phillips himself would be induced to turn his attention for the purpose of carrying out those practical objects which the Chairman had mentioned. There were few branches of metallurgy in which serious losses were not sustained by the employment of some old process, whereas in other departments of industry many important improvements had been introduced. The observation made by the Chairman with reference to the late Hugh Lee Pattinson had brought to his mind another subject—the neglect of so many important mineral products which still existed in this country, notwithstanding all the improvements made. With regard to the particular subject of silver in lead, he had in his own museum specimens collected 50, 60, or 80 years ago, of lead ore containing 40, 60, and 80 ounces of silver to the ton, which were left unwrought for years, because it was considered that they were not susceptible of economical application, whereas, by the improvements introduced, the production of silver in this country had become very considerable, a subject with which no one was better acquainted than the chairman. Those improvements had been the means of realising a very great quantity of silver from ores the produce of this country, besides which, the improvements of Pattinson and others had enabled them to treat a large quantity of foreign ores brought to this country for that purpose. The great increase which had taken place in the production of silver in this country was an encouragement for the carrying out of similar improvements. They had recently had a paper read before the Society upon the utilisation of waste substances, and he would renew the remark which he made on that occasion, viz., that in no branch of manufacture was there greater waste than in their metallurgic operations, and every process by which they could economise the substances now wasted was worthy of the highest consideration.

The Rev. Daniel Ace said, having formerly had the charge of the parish of Alston, it was his privilege to come in contact with the late Mr. Hugh Lee Pattinson, and he could testify that a more humble and liberal-minded man he was never privileged to converse with; for, notwithstanding his high attainments in science, he was ever ready to communicate his knowledge to others, and to do his utmost to promote the happiness of those with whom he was associated. In a religious point of view, he was desirous to promote that independence of thought, as well as liberty of action, which he (Mr. Ace), as a clergyman, conceived to be the glory of mankind.

Mr. Warrington expressed the pleasure he had derived some years since, from a visit to the smelting-works at Alston Moor, at which time, the flue which was suggested by Bishop Watson extended for a distance of three miles. He believed it was now considerably longer. From that place an enormous quantity of soot was annually taken, and he believed as much as 300 tons of lead was derived from that flue, which would have been driven off into the atmosphere as smoke, destroying vegetable and animal life.

Mr. J. A. Phillips said the fumes caught in well-constructed flues, generally amounted to 1 or 1½ per cent. of the lead contained in the ore put into the furnaces; but the amount of silver was very much smaller; and they found that the fumes from ores containing 20 ounces of silver to the ton, would in very few instances contain more than two or three ounces of silver. He had analysed the fumes from different parts of the flue, and had found that in the first 100 yards, the proportion of silver was greater than in the next 100 yards, until, as the chimney was approached there were scarcely any traces of silver. Instead of flues, condensers of various kinds had been employed, which were found very efficacious for the condensation of the fumes, and when employed with the Castillian or other blast furnaces, they did not materially impair the draft, since the furnace was not dependent upon the natural draft, but upon a blast forced in by machinery. When, on the other hand, they made use of reverberatory furnaces, a condensing chamber materially checked the draft from the flue, and every practical lead-smelter would bear him out that it was exceedingly difficult to obtain good results with a furnace having a bad draft. When speaking of the combination of silver and lead in the galenas, he remarked that it would appear in many cases that the sulphide of silver was combined mechanically with the sulphide of lead; whilst, in other cases, the two sulphides were in a state of chemical combination. Alluding to specimens upon the table, Mr. Phillips remarked that in the case of one of them, the silver was almost entirely lost if the ore was treated by washing, whilst in the other the loss of silver, by similar treatment, did not amount to more than two ounces to the ton. In the first case the sulphide of silver was mechanically combined, and in the second it was in a state of chemical combination with the sulphide of lead. Mr. Hyde Clarke had stated that in the metallurgic operations of the present day there was still a great waste of useful products. No doubt such was the case. There was a great want of chemical knowledge in the mining districts of the country. An instance occurred a short time ago, in which large quantities of oxide of iron usually called "gossan," were thrown away from a mine in Cornwall, it never having occurred to them to test it for silver; on its being examined, however, it was found to contain silver to the amount of £15 per ton, and as it was obtainable in large quantities, this discovery materially enhanced the value of the property. He had no doubt that not only silver, but nickel and cobalt existed in much larger proportion in the mineral districts than was generally imagined.

Professor Tennant observed that, on looking over some of the rubbish heaps in Shropshire, which had been cast away as refuse matter, he found a large portion of carbonate of lead, which had been regarded as calcareous spar. There were instances in which the carbonate of lead was apt to be overlooked even by those who had a practical knowledge of mineralogy, and a valuable product was thrown away simply owing to a want of acquaintance with its properties. He fully agreed with the remark that a better practical education was required amongst the people engaged in mining operations. The late Mr. Hugh Lee Pattinson was one who took that matter in hand, and he was happy to find that the example had been followed in other instances. He would particularly allude to the extensive mines under the superintendence of Mr. Sopwith, where thousands of men were employed. He believed the flue at the works at Alston Moor was nearly five miles in length, instead of three miles, as mentioned by Mr. Warrington. He (Professor Tennant) felt obliged to Mr. Phillips for the way in which he had described the operation of lead smelting, which was of the utmost importance when they considered its extent. With regard to the statistics of this subject, he believed the chairman would corroborate the statement that there was often difficulty in obtaining precise information.

The Chairman said that Mr. Tennant was in error. He could with very great satisfaction say that in his statistical inquiries, with but one exception, he had never been refused the information he asked for.

Professor Tennant was very happy to hear it. He found the value of the metallic minerals in this country was about £16,000,000 per annum; they were therefore a most important part of our national wealth, and any information bearing on the subject was necessarily of great interest. In conclusion, Professor Tennant pointed out the great importance of a more general study of mineralogy, and strongly recommended a visit to the works at Alston Moor, which he said would be highly entertaining as well as instructive.

The Chairman would ask the gentleman who had just addressed them, whether he could give them any information as to the combination of sulphide of silver with sulphide of lead.

Professor Tennant replied, that it was one of those difficult questions which had not yet been fully resolved, like that of the pure silver that was found in the copper of Lake Superior. Whether the combination was chemical or mechanical, he could not say; but his own impression was that the metals were mechanically, and not chemically combined.

Mr. J. A. Phillips said, that some years since he visited the mines of Lake Superior, and had paid some attention to the combination of the silver and copper. He had found some cases in which the two metals seemed to form an alloy, while in others he had found nicely formed crystals of native copper combined with equally well-formed crystals of silver, and on testing these crystals he found both nearly equally pure.

Mr. Hyde Clarke inquired whether it was not the case in the long flues, of which mention had been made, that the deposit of metal was always found in the largest proportion nearest to the furnace, and less towards the further portions of the flue. There was a gentleman present (Mr. John Phillips) who was able to give them some information as to the mining operations in Spain.

Mr. J. A. Phillips said with regard to the deposits in the flues of furnaces, he was not practically acquainted with the working of all the metals, but with reference to those with which he was specially acquainted, he could say that the largest deposits were in the immediate vicinity of the furnace; and in proportion to the distance from the furnace the amount of the deposit decreased. He had also observed that in certain ores—particularly those of silver—the metal was carried off by mechanical action. An old pupil of his engaged in works in Spain had informed him that he invariably found that the deposit of silver was richer near the furnace than elsewhere.

Mr. Hyde Clarke presumed that the stuff at the further end of the flue was not worth taking out.

Mr. J. A. Phillips remarked that in the works in Spain, and elsewhere, where silver ores were treated, the deposit, even at the further end of the flues, contained a sufficient amount of silver to render its collection a matter of importance.

Mr. John Phillips was largely interested in the smelting of lead and silver. The important question now was as to the loss of silver sustained in the operation of calcining the ores. In the works in Spain with which he had been connected, the poorer ores, which only yielded about 4 ounces of silver per 100lbs. of ore, were calcined in what was known as Brunton's Calciner, which answered well for ores of this description, but with ores of the richer class the process of calcining by manual labour was found to answer best, because the charge was more carefully stirred up, and there was consequently less loss through the ore being carried off by the draught. He was not competent to enter into the chemical part of the subject, but he had no doubt that with careful manipulation the loss might be much diminished. Reverting to the subject of lead smelting, he was glad to hear Mr. Phillips state the result of his observations as to the saving of lead in the flues in the shape of fumes, because it was a matter of great importance. There were some works in Spain, where the loss of lead in the fumes was very great. He particularly alluded to the Linares works, where the Castillian furnaces were employed, and the loss was considerable until they adopted the plan of the long flue. When this was done the saving during the first month paid a large portion of the expense of building the flue. Then again a saving in the length of the flue might be made by the use of condensers; and some improvements had been made in the forms of these condensers. One form had been mentioned as having been recently introduced, in which there was a series of falls of water so arranged as to cool the gases without interfering with the draft of the furnace. In the use of these condensers it was most important to take care that the draft was not interfered with. If the draft was kept perfect they were of great value, and saved the cost of erecting long flues.

The Chairman said there were one or two points to which it was important that their attention should be called before this discussion closed. In the first place, branching from the subject, although associated with it, there was one important fact connected with lead. In Durham and Northumberland—taking the year 1857—they had 17,000 tons of lead produced, which gave 74,000 ounces of silver; whilst in Cumberland they found that, with a produce of only 4,700 tons of lead they had 43,500 ounces of silver. Going on to Yorkshire, they found that 7,875 tons of lead were produced, and yet they only obtained from that lead 445 ounces of silver. The remarkable point was, that going southward they found, as they got into Flintshire, with a produce of 2,280 tons of lead, they had 13,300 oz. of silver. With 5,509 tons of lead produced in Cardiganshire, they had 35,000 ozs. of silver. Going farther southward into Cornwall, with 6,000 tons of lead produced in 1857, they had 224,277 ozs. of silver; and in Devonshire, with 1,535 tons of lead produced, they had 50,200 ozs. of silver. There was no question but that there was some law regulating this, and it was a subject which called for inquiry. Again they had the important lead districts of Derbyshire, producing 6,000 tons of lead, from which it was stated, he believed with some degree of truth, that no silver whatever was obtained. He said, with some *degree* of truth, because the white lead manufacturers, obtaining the material from the Derbyshire smelters, had by the use of Pattinson's process, obtained silver from that lead, although it was not obtained by the Derbyshire smelters themselves. Mr. Phillips had mentioned the extraordinary case of "gossans," in connection with a mine in Cornwall, containing a large quantity of silver. This had been further exemplified in Cambourne, in Cornwall, where the fissures, in some cases at right angles to the main lode, and in others parallel to it, were found to contain an enormous quantity of silver existing as a chloride of silver mixed with the oxide of iron. Whilst waiting at the Cambourne station one day, he saw two tons of that material sent away, which was said to be worth £3,000, from the silver it contained. Mr. Phillips had also mentioned the importance of looking for nickel and cobalt. There was every reason to believe that Cornwall contained large quantities of cobalt, which was now thrown away. This metal having been found in large quantities in the sandstone formation of Alderley Edge, some 50 years ago, a gentleman of Liverpool established works at that place for the preparation of smalt, but the excise came down upon him for the glass duty, and he was surcharged to an extent that ruined him; works, however, were being again established in that place. Cobalt also existed to a great extent in Cumberland, although our principal supply was obtained from the German, Norwegian and Swedish mines. The chairman further mentioned a curious fact, connected with the mines of the Duke of Devonshire. At Grassington, the lead was found only in the bands of limestone, and none whatever existed in the shale, whilst at a distance of ten miles off, at Cononley, the lead was found entirely in the shale, and none in the limestone. The cause of this he was not in a position to explain; but it was important that a better series of observations should be made and recorded. He fully agreed with what had been said by Professor Tennant as to the want of better education of a practical nature amongst the mining community, and those connected with mineralogical pursuits. He was sure they were losing a large amount of valuable products, from the want of proper knowledge upon the subject. As an example, he might mention that they were producing large quantities of sulphur from the iron pyrites of Wicklow, which was conveyed to St. Helen's to be manufactured into sulphuric acid, and the material remaining from that manufacture which was formerly thrown away, was now disposed of to another house, and being roasted with common salt, copper was produced as a muriate and precipitated by iron, and a chloride of silver was likewise produced, which, being dissolved out by a strong brine, was afterwards precipitated by zinc. The silver cake was sent to the metropolis, and instead of fetching the usual price of 5s. per oz. it brought from 8s. to 10s. per oz., on account of the gold it contained. This showed what could be done with a proper knowledge of the subject. He had now to propose a vote of thanks to Mr. Philips for the valuable paper he had brought before them on the present occasion.

A vote of thanks was then passed to Mr. Phillips.

The Secretary announced that on Wednesday evening next, the 4th May, a paper, "On Timber for Ship-building," by Mr. Leonard Wray, would be read.

Home Correspondence.

PRODUCTS OF THE COMBUSTION OF COAL GAS.

Sir,—In order that the subject of my last communication to you may not be misunderstood, I think it right to state again that I have never denied the presence of a small portion of sulphur compound in coal gas; but what I do state is that oil of vitriol cannot, under the ordinary method, be produced from its combustion.

Dr. Letheby, in his last communication, recommends a plan whereby I shall be able to obtain this, to me, unattainable compound, viz., oil of vitriol; now the plan here suggested is the one I have used with others on a large scale five years' since, but without success; and it is very curious that this identical plan, now suggested by Dr. Letheby as his own, for proving the *formation* of oil of vitriol, is recorded in the third volume of the *Journal of Gas Lighting*, Sept. 1854, page 528, in a valuable paper by Mr. Lewis Thompson, as a means of proving that oil of vitriol is *not formed* by the combustion of coal gas. Now it is rather singular that Dr. Letheby has never seen this paper, especially as he has on former occasions quoted so liberally from the *Journal of Gas Lighting*. Mr. Lewis Thompson stands so high as a chemist, and especially in all matters connected with gas, that I can hardly think he can have been deceived, especially as his results have been so completely confirmed by other eminent chemists.

Dr. Letheby has not thought fit to notice the statement as to there being only the $\frac{1}{2000}$th part of ammonia in raw gas instead of over *one per cent.*, or the $\frac{1}{100}$th part, as stated by me; and in spite of his own daily analyses and the opinion of the highest authority in gas matters, he now (without acknowledging his mistake) tells you that the numbers are not his but Mr. Wright's. Is it not possible that some such mistake may have occurred throughout, and thus have made Dr. Letheby imagine he had got oil of vitriol when in fact it was something else?

I am, &c.,

F. J. EVANS.

April 19, 1859.

JAPAN VEGETABLE WAX.

Sir,—You did me the honour, some time back, to print in our *Journal*, Vol. IV., some rough suggestions sketched out by me at the suggestion of Sir William Hooker, to assist travellers in estimating the value of vegetable oils, tallows, and waxes, which they might come upon in out of the way parts of the world.

With the exception of liquid oils from the East Indies, and Shea butter from Africa, and palm kernel oil from the same place, there have been no very considerable importations of remarkable fatty matters until quite recently, when one has taken place on so large a scale, and from so new a country, as, in my opinion, to become of public interest.

About 700 tons of "Japan wax" have arrived in one ship, consigned to Messrs. Baring. This wax, as I am informed by Sir William Hooker, is obtained from the *Rhus Succedaneum*, which I believe to be a species of *Sumach*, and, therefore, a free grower. The wax in its properties appears to be half-way between wax and vegetable tallow, or Bassia butter.

The small parcels which have formerly reached this country have been used in our works in substitution for wax, in substitution for hard neutral fat, and, after conversion into the acid state, both for candles and night-lights. For the last, a mixture of Japan wax and fat of low melting-point makes a compact, soft, wax-like body.

I am, &c., GEO. F. WILSON.

Price's Patent Candle Company (Limited),
Belmont, Vauxhall, S., 25th April, 1859.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. Annual Meeting.
London Inst., 7. Mr. John Ella, "On Chamber, Orchestral, and Ballet Music."
Entomological, 8.
Brit. Architects, 8. Anniversary.
Tues. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Civil Engineers', 8.
Pathological, 8.
Photographic, 8.
Wed. ......Society of Arts, 8. Mr. Leonard Wray, "On Timber for Ship building."
Geological, 8. 1.—Dr. Falconer, "On the Ossiferous *Grotta di Maccagnone*, near Palermo;" 2.—Professor Buckman, "On some fossil Saurian Eggs in the Great Oolite of Cirencester; 3.—Baron A. de Zigno, "On the Jurassic Flora;" 4.—Professor Phillips, "On some Sections south of Oxford."
Thurs .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Royal Soc. Club, 6.
London Inst., 7. Mr. J. W. Hastings, "On Commercial Law, in connection with the Travers Testimonial Fund."
Antiquaries, 8.
Linnæan, 8. 1.—Dr. Hicks, "On Certain Organs in the Wings of Insects;" 2.—Dr. Seemann, "On the genera *Camellia* and *Thea*.
Chemical, 8. 2. Mr. S. C. Wood, "On Bases produced by nitrous substitution." 2. Mr. Blockey, "On the Manufacture of Sulphate of Copper."
Artists and Amateurs, 8.
Royal, 8½.

FRI. ......Archæological, 4.
Royal Inst., 8. Dr. Druitt, "On Houses in Relation to Health."
SAT..........Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered on 1st, 2nd, and 4th April, 1859.

107. Galway Harbour—Copy of Report and Plan.
157. Greenwich Union—Return.
171. Poor Rates—Return.
50. Local Acts (48, Dungarvan Harbour Embankment)—Admiralty Report.
166. Boundaries of Boroughs—Return.
169. Proprietors (Scotland)—Return.
127. Exchequer Bills—Account.
172. Army (Purchase and Sale of Commissions)—Returns.
173. Army (Purchase and Sale of Commissions)—Copy of the data upon which Sir C. Trevelyan founded his statements.
97. Bill—Public Offices Extension (as amended by the Select Committee.)
Foreign Service Messengers—Papers.

Delivered on 5th April, 1859.

167. National Education (Ireland)—Returns.
176. Decimal Coinage—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 15, 1859.]

682. J. Donat, 6, Rue Paradis Marais, Paris—Imp. in apparatus used with matches for obtaining instantaneous light.

Dated 19th March, 1859.

700. J. W. Hart, 60, St. Mary-Axe, London—An apparatus for the destruction of flies and other insects. (A com.)

Dated 22nd March, 1859.

722. W. Weild, Manchester—Imp. in machinery and arrangements for coating slips, sheets, rods, and bars of metal, and laths, rods, and boards of wood, and similar articles formed of other substances, with paints, varnishes, and other like preparations, and drying the same.
727. D. L. Banks, Kennington, Surrey—Imp. in suspension rail or road ways, and in machinery or apparatus connected therewith.
734. J. Macintosh, North Bank, Regent's-park, and Major G. Rhodes, Regent-street—Imp. in tents and such like coverings for shelter against the weather.

Dated 29th March, 1859.

778. T. Carr, Bebington, Chester—Imp. in machinery for disintegrating artificial manures and various other substances.
779. C. L. Roberts, Clerkenwell—Imp. in cigars.
781. J. W. Kelly, Ennis, Ireland—Imp. in gas burners.
782. E. de Caranza, 97, Rue des Petits Champs, Paris—A new system of gas lighting through new apparatuses and matters richer in gas than pit coal.
783. E. N. Normington, 19, High-street, Camden-town—The cleansing and re-manufacturing of old used dirty railway grease for the manufacturing of new railway grease, for the cleansing and re manufacturing of old used cotton waste, tow, or any textile fabrics, and for the purifying of oils or any fatty matter.
785. R. Searle, Woodford Wells, Essex—Imp. in apparatus used for transmitting signals by electricity for telegraphic purposes, and in the construction of telegraphic cables.
786. I. Spight, Glandford Briggs, Lincolnshire—Imp. in horse hoes.
787. T. Taylor, Vere-street, Middlesex—Improved means of giving increased strength to paper.
788. H. P. Burt, Charlotte-row, Mansion-house—Imp. in apparatus for preparing and preserving timber.
789. H. Moss, 62, Brill-row, Somers-town, and T. West, 5, Jewin-street—A machine for the cutting of leather for every purpose, and cutting cloths, linen, and other fabrics and materials.

Dated 30th March, 1859.

791. J. H. Linsey, 103, Cheapside—Certain imp. in binding or covering books.
793. W. V. Edwards, Swindon, Wiltshire—Imp. in the construction of ways and apparatus to facilitate the conveyance of mails, goods, and passengers.
794. G. T. Bousfield, Loughborough park, Brixton—Imp. in preventing explosions in steam boilers. (A com.)
795. T. D. Shipman, Toronto, Canada West, N.A.—Imp. in apparatus for stamping and printing. (Partly a com.)
796. H. Jefferies, Birmingham—Imp. in castors for furniture.
797. J. Cartwright, Shrewsbury—An improved implement for crushing clods and pulverising the surface soil, also convertible into a press wheel roller.
798. C. P. Coles, R.N., Southsea—An apparatus for defending guns and gunners in ships of war, gun boats, and land batteries.
799. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of certain alkaline silicates and in the production therefrom of liquor silicis or liquid flint.
800. A. V. Newton, 66, Chancery-lane—An improved governor for marine and other steam-engines. (A com.)
801. W. Smith, King-street, Smithfield, and E. Smith, Hamburgh—Imp. in means or apparatus for the purpose of regulating the flow or passage of fluids.

Dated 31st March, 1859.

802. J. Lacy and S. Simpson, and H. Smith, Travis Holme Mill, Walsden, near Todmorden, Lancashire—Certain imp. in machinery for preparing and spinning cotton and other fibrous materials.
803. C. Pickering, Tonbridge, Kent—Improved apparatus for brewing.
804. R. C. Ross, Glasgow—Improved apparatus for cultivating land.
805. T. Ivory, Edinburgh—Imp. in rotary engines.
807. A. Morton, Morton-place, Kilmarnock—Imp. in sextants or quadrants for nautical purposes, and which are also adapted to the measuring of altitudes or angular distances.
809. J. S. Bateson, 17, Bolton-street, Mayfair—Imp. in generating steam and in the apparatus employed therein.
810. F. Morton, James-street, Liverpool—Imp. in the construction of fences and the posts or pillars for the same, parts of which improvements are also applicable to the construction of gate posts or poles for telegraph purposes or for signal posts.
811. W. E. Newton, 66, Chancery lane—Imp. in mills for cleaning rice. (A com.)
812. A. V. Newton, 66, Chancery-lane—Imp. in the construction of steam boiler and other furnaces. (A com.)

Delivered on 1st April, 1859.

813. D. K. Clark, 11, Adam-street, Adelphi—Feed water heating apparatus.
815. I. Sigismund, Hull, Yorkshire—Certain imp. in the manufacture of artificial teeth, and in the apparatus connected therewith. (Partly a com.)
816. R. A. Brooman, 166, Fleet-street—Imp. in solidifying, pressing, and moulding, (A com.)
817. R. A. Brooman, 166, Fleet-street—A new preparation of indigo for dyeing. (A com.)
819. W. E. Newton, 66, Chancery-lane—An improved process of manufacturing sulphate of lead, carbonate of lead, nitrate of potash, and sulphate of soda. (A com.)
820. J. J. Davis, Percival-street, Clerkenwell—An improved pad, applicable for inking, damping, and other like purposes by hand.
821. W. Tod, Glasgow—Imp. in marine steam engines.
822. Y. M. Thomas, 2, Rue St. Appoline, Paris—An improved propeller for ships, vessels, boats, and water wheels.

Delivered on 2nd April, 1859.

823. J. Desmet-Séaut, 4, South-street, Finsbury—An improved gas burning and lighting apparatus.
825. J. Hall, Queen's-road Chelsea, and J. S. Sparkes, St. John's Wood—An improved application of machinery for the purpose of hoisting, lowering, pulling, or drawing weights.
827. S. Desborough, 24, Noble-street—Imp. in making up needles, steel pens, and other small articles for sale.
829. W. Mather, Manchester—An improved apparatus for catching and destroying flies and other insects.
831. M. Scott, 26, Parliament street, Westminster—Imp. in diving apparatus.
833. T. Richardson, and G. W. Jaffrey, Hartlepool, Durham—Imp. in the arrangements and construction of harbours of refuge, breakwaters, sea walls, or barriers, and other like structures.

Dated 4th April, 1859.

835. F. Potts and R. Brough, Birmingham—Certain imp. in the manufacture of calico printing rollers or cylinders, also in the machinery and apparatus for performing certain parts of the same, and which said apparatus are also applicable, separately or conjointly, to the manufacture of parallel and other metallic tubes, and the rolling of the metal for the same or other purposes.
837. C. F. Kirkman, Argyl street, Regent-street—Protecting telegraphic wires, and in using them for subterranean and submarine purposes.
839. W. Brown and C. N. May, Devizes—Imp. in haymaking machines.
841. W. E. Newton, 66, Chancery lane—An Imp. in ladies' hooped skirts. (A com.)
843. C. Russell, Stubbers, near Romford—An Imp. in the working of marine engines.
845. D. B. White, M.D., Newcastle-on-Tyne—Imp. in arranging ships' and other pumps.
847. D. Sowden, Bradford, Yorkshire—Imp. in jacquard machines employed for weaving figured goods or fabrics.

Dated 5th April, 1859.

849. G. Hazletine, 4, Southampton buildings, Holborn—Imp. in sewing machines.
851. L. Brierley, and H. Gearing, Birmingham—A new or improved method of ornamenting metallic bedsteads and other articles of metallic furniture.
853. G. F. Chantrell, and E. Dutch, Liverpool—Imp. in the apparatus for regulating the quantity of water to be used for the flushing of water-closets and other purposes.

855. J. Hetherington, Manchester, and T. Webb and J. Craig, Tutbury, Derby, Imp. in machinery or apparatus for spinning and doubling cotton and other fibrous materials.
857. N. Libotte, 33, Boulevart St. Martin, Paris—Improved safety apparatus to be applied to cages in the drawing of coals.

Dated 6th April, 1859.

859. T. P. Luff, Shepton Mallet, Somersetshire—Imp. in cheese vats.
861. J. A. H. Ballande, Paris—An imp. in the preparation of writing paper, and ink to be used thereon.
863. J. Rogers, 9, Queen-square, Bartholomew Close, and E. J. Tweed, 22, Castle-street, Falcon-square—Imp. in coating conducting wires used for electric telegraphic purposes.

Invention with Complete Specification Filed.

860. I. Adams, Massachusetts. U. S.—An improved tnbuler chain cable guide for vessels' bulwarks. (A com.) 6th April, 1859.

[*From Gazette*, *April* 22, 1859.]

Dated 3rd March, 1859.

572. W. Mitcalfe, Coal Exchange, London—Imp. in discharging cargoes, and in raising and lowering bodies.

Dated 5th March, 1859.

588. R. Leake and M. Sykes, Barnsley, Yorkshire—Imp. in furnaces for consuming smoke and generating heat, parts of which improvements are applicable to furnaces generally.

Dated 9th March, 1859.

616. J. Cooke, Cheltenham—Imp. in apparatus for giving signals on railways and vessels, and other such like uses.

Dated 16th March, 1859.

662. H. Ambler, Halifax—Imp. in breech-loading ordnance, and in the means of producing part or parts thereof, which improvements are also applicable to what are called small arms.

Dated 17th March, 1859.

680. A. Mein, St. Rollox, Glasgow—Imp. in making glass bottles, and in the apparatus connected therewith.

Dated 23rd March, 1859.

740. B. Browne, 52, King William-street, London Bridge—A new method of working or operating switches and signals on railways by improved apparatus for that purpose. (A com.)

Dated 26th March, 1859.

762. William Redgrave, Tavistock-street, Middlesex—An improved pillow travelling cap.
764. S. Dreyfous, G. Richer, and E. Cormier, Paris—Imp. in preserving eggs.
792. J. W. Hadwen, Kebroyd Mills, Halifax—A new art or manufacture for converting certain kinds of silk waste into yarns or threads.

Dated 31st March, 1859.

806. T. Ivory, Edinburgh—Imp. in steam boilers and furnaces for the same.

Dated 2nd April, 1859.

824. A. Ripley, 21, Bridge street, Blackfriars, and J. Roberts, Nelson-square, Bermondsey—Imp. in machinery for striking or scraping leather and tanned or untanned hides.
826. A. Bessemer, Tavistock-terrace, Upper Holloway—Imp. in furnaces to be employed in the manufacture of iron and steel.
828. J. Skertchley, Ashby-de-la-Zouch, Leicestershire—Imp. in apparatus for regulating the pressure of gas.
830. A. Paget, Loughborough, Leicestershire—Imp. in the machinery or apparatus for the manufacture of looped fabrics, and in the manner of constructing the same.
822. M. Coupland, Haggerstone, Middlesex—Imp. in furnaces.

Dated 4th April, 1859.

836. J. Eccles, Blackburn—Imp. in machinery for making bricks, tiles, and other articles formed of plastic materials.
840. J. H. Burton, Enfield Lock, Middlesex—Imp. in the manufacture of barrels for small fire arms.
842. A. V. Newton, 66, Chancery-lane—An improved construction of retarding apparatus or break for railway carriages. (A com.)
844. M. A. Crooker, New York, U. S.—Imp. in paddle wheels for steamers.
846. E. Morewood, Endfield, Middlesex—Imp. in coating metals.

Dated 5th April, 1859.

850. E. Fairburn, Kirklees Mills, Mirfield—Imp. in machinery for carding wool and other fibrous substances.
854. B. Browne, 52, King William street, London Bridge—Imp. in propelling ships or other vessels through water. (A com.)
858. F. M. Crichton, Stoke Abbey, Stoke Bishop, Westbury-upon-Frym, Gloucestershire—Imp. in clocks or time keepers.

Dated 6th April, 1859.

862. W. Owen, Rotherham, Yorkshire—Imp. in the manufacture of railway wheels and tyres and in the apparatus employed therein. (Partly a com.)
864. J. Scoffern, 4, Barnard's-inn—Imp. in lubricating projectiles and cartridges.

Dated 7th April, 1859.

866. A. Chaplin, Glasgow, Lanark—Imp. in steam boilers.
868. R. Wardell, Stanwick, and H. Kearsley, Ripon, Yorkshire—Imp. in reaping machines.
870. John Lakin, junr., Hall End, near Tamworth—A new or improved agricultural drill.
872. J. Rawlings, Carlton Hill East—Improved construction of boot tree.

Dated 8th April, 1859.

874. W. H. Smith, Philadelphia, U. S.—Imp. in the construction of cartridges, and in the fire arms for using the same.
876. William Campion, Nottingham—Imp. in machinery for the manufacture of looped fabrics.
878. M. A. F. Mennons, 32, Rue de l'Echiquier, Paris—An improved articulated joint for water, gas, and steam pipes. (A com.)
880. N. A. Grumel, Paris—Imp. in dying cotton, wool, silk, flax, and other fibrous materials or fabrics.
882. W. Hooper, Mitcham, Surrey—Imp. in re-working or re-manufacturing compounds of india-rubber and sulphur.

Dated 9th April, 1859.

888. T. Barnett, Oldham, H. T. Sourbuts, and W. Loynd, Hyde, Imp. in steam engines.
890. J. Hawkins, Lisle-street, London, "Certain imp in the manufacture of stirrups, bits, spurs, buckles, and other such like articles connected with harness and saddlery.
892. R. J. Derham, 46, Redcliffe-street, Bristol—Imp. in cheese vats.
894. C. F. Vasserot, 45, Essex-street, Strand—A new motive power applicable to tanneries. (A com.)
896. H. F. Gardner, Boston, U.S.—Imp. in machinery for blocking or crimping the uppers of boots and shoes, and in treeing boots. (Partly a com.)

Dated 11th April, 1859.

904. A. Bower, Liverpool—Imp. in or applicable to the keels of navigable vessels.
906. R. A. Brooman, 166, Fleet-street—Imp. in candle moulds. (A com.)
908. W. H. Barlow, Great George-street, Westminster—Imp. in beams and girders.

Dated 12th April, 1859.

910. Lieut. W. Clark, R.N., Langhaugh, Galashiels, Scotland—An improved safety block to be used for lowering ships' boats, the same being applicable to other like or analogous purposes.
912. P. Aitchison, Sheffield—Imp. in taps.
914. E. T. Noualhier, Paris—An improved ventilator.
916. P. Hill, Manchester, and J. Moore, Salford—Imp. in weaving double pile fabrics.
918. M. Castay, Paris—Imp. in metallic bridges.
920. J. Ward, King's Norton, Worcestershire—An imp. or imps. in working fly presses used for raising metals, coining, and other like purposes.
922. S. Tatton, Leek, Staffordshire—Imp. in preparing and treating silk, and imps. in dyeing silk.

Dated 13th April, 1859.

924. W. A. Martin and J. Purdie, Woolwich—Imp. in fire bars.
928. W. Craft, 12, Cambridge-road, Hammersmith, and T. Wilson, Bradmore House, Chiswick—Imp. in the manufacture of pinafores and bibs for children.
632. J. L. Stevens, 1, Fish-street-hill, London—Imp. in the fire grates of locomotive, marine, and other furnaces.

Inventions with Complete Specification Filed.

935. J. Luis, 1b, Welbeck-street, Cavendish-square—A new cooling apparatus for liquids, especially beer. (A com.)—14th April, 1859.
988. A. W. Williamson, University College, London—Imp. in making extracts from liquorice root.—19th April, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *April* 22, 1859.]

April 21st.

2389. J. Luis.
2391. A. P. A. Beau.
2392. J. Kinsey.
2395. G. Speight.
2408. B. Foster.
2410. J. Smith.
2412. P. Brunon.
1413. W. Kirrage.
2427. E. T. Hughes.
2438. M. A. F. Mennons.
2463. G. P. Evelyn.
2478. S. Davey.
2859. J. Webster.
2898. I. Ketchum.
282. J. Hosking and T. Cock.
348. T. Moss.
404. H. Gardner.
481. J. Grimond.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette*, *April* 15, 1859.]

April 11th.

879. R. B. Lindsay.
963. C. Nickels.

April 12th.

876. R. S. Newall.
882. P. Robertson.
889. S. C. Lister.

[*From Gazette*, *April* 22, 1859.]

April 18th.

945. W. Crosley and G. Goldsmith.

April 19th.

994. C. Switt and J. J. Derham.

April 20th.

953. W. Maugham.
958. A. Symons and E. Burgess.

[*From Gazette*, *April* 26, 1859.]

April 21st.

1006. T. Heiffor.

April 23rd.

997. R. Lakin.
1003. C. A. Arnaud.
1058. I. Holden.
1097. G. J. Firmin.

Patent on which the Stamp Duty of £100 has been paid.

[*From Gazette*, *April* 22, 1859.]

April 19th, 1859.

452. J. Carnaby.

Journal of the Society of Arts.

FRIDAY, MAY 6, 1859.

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EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th ult., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONI.

The Council have arranged for two Conversazione during the present Session; the first, tomorrow (Saturday), the 7th inst., at the Society's House, the card for which will admit the Member only; the second, on Saturday, the 28th inst., at the South Kensington Museum, the card for which will admit the Member and two ladies, or one gentleman. Cards for each of these evenings have been issued. Members who have not received them are requested to communicate with the Secretary of the Society of Arts.

The articles to be exhibited at the Conversazioni to-morrow evening, will remain at the Society's House during Monday, for the inspection of members and their friends.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

TWENTY-FIRST ORDINARY MEETING.

Wednesday, May 4, 1859.

The Twenty-First Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 4th inst., Thomas Chapman, Esq., F.R.S., Chairman of the Committee of Lloyd's Register, in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Carey, Stephen
Ellison, Thomas
Haywood, G. R.
Holder, Joseph
Jones, Charles
Wilson, William Newton

The Chairman regretted he seldom had an opportunity of being present at the interesting and highly useful meetings of this Society, and his only claim to the honourable position of presiding on the present occasion was, that he had for upwards of twenty-four years been chairman of the Committee of Lloyd's Register of British and Foreign Shipping; he had therefore been invited to undertake this duty, a request with which he had had much pleasure in complying. As he believed allusion would be made in the course of the observations that would fall from his friend, Mr. Wray, to the Society of Lloyd's Register of British and Foreign Shipping, he thought it desirable that he should state very briefly what were the objects of that society. Previously to the year 1834 there existed in England only two register books for the purpose of giving to the public a classification of British shipping. The means they adopted were by no means adequate to the end they proposed, as would be understood when he stated that they assigned a character to ships, not according to the description of material of which they were composed or the mode of construction, but according to the place at which they were built. There was a term familiar to all present—that of a ship standing "A 1 at Lloyd's;" but the precise meaning of that term, or the means by which the character of A 1 was obtained, might not be generally known. As he had said, the former society to which he had alluded gave the classification to ships according to the place at which they were built. To those built in London they assigned the character of A 1 for twelve years; at Bristol, eleven years; at Gloucester, ten to eleven years; whilst, in the north of England they only assigned the character of A 1 for a period of seven or eight years. It would thus be seen that there was no inducement for the north of England to build good ships, while there was every inducement for the south of England to build bad ones. The institution over which he presided—the Committee of Lloyd's Register—was formed for the purpose of correcting this evil, and the principle they had adopted was to assign the character of A 1 according to the materials of which the ships were built, and the manner in which they were constructed. The committee took means for obtaining the best information they could as to the durability of the various kinds of wood used in the different parts of a ship. Thus, to the higher classes of wood was assigned a period of twelve years; to those of lower quality, ten, nine, eight, or seven years; and to the the lower American woods only four years, for the character of A 1, while the position in the ship of the various kinds of material, and their liability to exposure to the different elements materially affected its character. The Society of Lloyd's was one of great importance not only to the mercantile marine of the country, but also in a national point of view. He was sure the people of this country felt no deeper interest in any subject than in our national defences; and, therefore, any observations that might fall from his friend Mr. Wray, tending to afford information as to the means whereby we could procure timber for ship building, would be of the greatest interest, for it would be allowed by all that nothing was more important to the welfare of this country than upholding "the wooden walls of Old England."

The Paper read was—

ON TIMBER FOR SHIP-BUILDING.

By Leonard Wray.

As the greatest maritime nation in the world, England is infinitely more interested in the subject of ship-building than any other country; and any information—any suggestion—tending to benefit that great national interest, must have a certain importance in the eyes of the community, from the very magnitude of the subject involved, however humble the individual may be who ventures to offer it.

It is *this* belief that has induced me to travel so far out of my own particular pursuits as I have done, in undertaking to present this paper to the notice of the Society of Arts; and if, from the varied experience and observation of my life, I can bring to bear upon this subject any useful facts, and can offer any practical suggestions, I shall esteem my present effort as being a very happy and a very grateful task.

From time to time during my life I have had a great deal to do with a number of the principal timber woods of Europe, Asia, Africa, and America, which are known and classed by the timber-merchants and ship-builders of Europe; and I may moreover say, that I am very fairly acquainted with several timber woods which are almost wholly unknown in this country.

With such a knowledge of these timbers, I have long been struck with the fact that, when used in the construction of ships, their accredited durability seems woefully at variance with that which we find possessed by the same descriptions of woods when they are used in various ways on shore. Timber, which has the reputation of remaining perfectly sound for one hundred (and even for *several* hundred) years, in various structures, such as noblemen's mansions, churches, cathedrals, and other ancient public edifices, has no such high and flattering estimate placed upon it when, for the purpose of ship-building, it is brought under the rigid classification of that deservedly great and potent body known all over the world as "*Lloyd's*." On the contrary, we find, in the "Rules and Regulations" of that association, these self-same descriptions of timber classed no higher, in any case, than thirteen years (in the first instance), even with all the well-defined advantages of copper fastening, and other requirements, indispensable in a first-class ship! True, this term may be renewed for a further period of five years (being eighteen years in all) by thoroughly opening up the ship, from stem to stern, for a critical survey; and by making all those alterations, additions, and improvements in her hull and rigging, which the surveyors may think necessary, to effect a genuine and complete "*restoration;*" but this "*restoration*" is in general so troublesome and so expensive a course, that in nine cases out of ten the owner had better build an entirely new vessel than have recourse to it.

A ship being once off the first letter at Lloyd's, very rapidly runs down the scale of her classification, unless kept up to a certain letter by constant surveys and expensive repairs: but through these I do not purpose following her.

We have had instances, and those tolerably numerous, of ships, constructed of teak, mahogany, and even oak, lasting for a very long series of years, and being comparatively sound in their timbers when wrecked or broken up. On the other hand, cases are by no means rare of vessels, built even in the Government dock-yards, being—so to speak—unsound from the day they first entered the water. Indeed we can recal instances, and might give the names, of men-of-war which were said to be thoroughly rotten before they were ever launched!

These speaking facts, exhibiting as they do such startling contrasts, and bearing so seriously upon one of the most important of all questions to us, as a great maritim nation, may well arrest our attention, and demand an earnest unprejudiced investigation.

No sane man will, for a moment, call in question the justice or wisdom of those rules established by Lloyd's for the building and classification of ships; for the experience of more than 120 years guides them, and the telling events of each succeeding day add their testimony to confirm the lessons of the past. The very rock upon which that noble association is founded is—"experience;" turned to practical account by the clear heads and comprehensive minds of its leading members. That such a body should originate, or even suggest, experiments, is entirely foreign to its character and to its vocation; but, when independent enterprise has fully tested and proved a case bearing upon the construction of ships, it is then for Lloyd's, acting upon the experience so gained, to adopt and sanction the improvement or alteration, if they deem it worthy of that attention.

But in saying this, I nevertheless feel convinced that any useful and judicious experiments, tried by individuals, would always be fairly viewed and fairly encouraged by Lloyd's.

I have already said that the subject of ship-building embraces one of the most important questions we can possibly discuss; and to recognise this we need only refer to the Official Reports on the Merchant-Shipping of the United Kingdom; leaving our Royal Navy to be spoken of hereafter.

According to these Reports we find that we had:—

In 1854, of sailing and steam vessels 17,407, manned by 162,416 sailors, and amounting to 3,729,093 tons.

In 1856, of sailing and steam vessels 19,270, manned by 176,387 sailors, and amounting to 4,211,482 tons.

In 1858, of sailing and steam vessels 20,071, manned by 177,832 sailors, and amounting to 4,325,242 tons.

This last amount of tonnage must, I presume, represent a value of upwards of thirty-five millions sterling, upon which we may safely place an annual depreciation and loss of from ten to fifteen per cent.

But if we add to this the value of our Royal Navy, with its annual depreciation and loss, we shall gain some idea of the extreme magnitude of this question.

Timbers Used in Ship-Building.

According to Lloyd's classification of timbers, we find that *first class* comprises only the following:—

The English and the African oak, the live oak of America, the mora and greenheart of Guiana, the teak and saul of India, and the iron-bark of Australia—being eight in all—of which number America supplies three; India, two; and Europe, Africa, and Australia, only one each.

These timbers are all close-grained and compact; hard, strong, heavy, and durable, being more or less naturally impregnated with certain oily, resinous, or astringent matters. The oaks (containing an acid and an astringent principle) are indubitably more liable to "rot" than the other named woods, which abound in oily or resinous matter; hence we find ships built of the best English oak, frequently destroyed very speedily by "dry rot." I do not, however, say that even a wood so abounding in oil as the teak, does not occasionally exhibit decay;" on the contrary, experience has shown that this timber sometimes does so to an unexpected degree. On this point, however, I must beg of you to remark, that the varieties of teak are numerous, and that the character of the wood is very materially influenced by the peculiarities of climate, soil, and seasons in the locality from which it is obtained. Thus, we have the (finest description of) teak from Malabar; that from Travancore, from Ceylon, from Java, from the Malayan Peninsula, from the Burmese territories, and from the Tenassarim provinces. Of all these the Burmese and Tenassarim varieties are held to be the most inferior, simply because the great proportion of that shipped both at Rangoon and at Maulmain is timber grown on the rich, low, alluvial soils formed by the great rivers on whose waters they are eventually floated to market. In justice, however, to these ports of supply, I must state the fact that, both in Burmah and Tenassarim, the quality of teak, as a matter of course, varies according to the locality and soil on which it is grown; And we may therefore very fairly class the timber obtained from them as being good, better, and best. We find teak grown on high, dry, and open land of a fine quality, being closer and more compact, and abounding in a mild, bland oil, which scarcely affects the iron bolts that may be driven into it. Whereas that grown in the dense forests of the wet, low-lying, alluvials, is lighter, coarser-grained, and contains an acrid oil, which not only affects iron very materially, but even, to a certain extent, poisons and inflames the hand which has been pierced by its splinters.

We find, also the weight and consequent specific gravity of teak varying in a most remarkable manner, viz., from a minimum of ·583 to a maximum of 1·056 (according to the experiments by Mr. Seppings); although for all practical purposes we may take the range to be from ·600 to ·750.

You are all, of course, aware that differences in situation and soil create corresponding differences in oak, in elm, and in all other English timber woods; but because teak happens to have its *habitat* in the "nethermost parts of the earth," this simple law of nature seems to be overlooked by all, save by those few who have made these subjects their especial study.

The greenheart, the mora, the saul, and the iron-bark, have likewise their differences, both of kind and locality, but they are by no means of so important a nature as to demand the same marked notice as I have taken in respect to the varieties of teak.

These eight descriptions of timber hold, then, a very high and deserved character from Lloyd's classification; for with either of them may a first-class ship be built without the admixture of any other wood.

But upwards of twenty other kinds of timber are permitted to be used, in certain specified portions of a first-class chip; and some of these, at least, are no doubt working themselves up into a place amongst the highest class woods.

At first sight it may appear somewhat harsh, and even unreasonable, to place such a magnificent timber as the mahogany in the category of second-rate woods, the more so as we have had many well authenticated instances of the extraordinary strength and durability of ships built almost entirely of mahogany; amongst which I may mention the oft quoted case of the Spanish 80-gun ship named Gibraltar, captured by the English in 1757, and broken up at the age of 100 years when all her timbers were found to be perfectly sound. But we must, in relation to these particular cases, bear in mind two circumstances which are in themselves all important, viz., that in the first place, only the choicest and most superior description of mahogany was employed by the Spanish government in the construction of the Gibraltar (which was built at the Havannah), and that no expense whatever was spared in the selection. Secondly, that such a selection of choice mahogany for the entire construction of a merchant ship at the present day would be far too expensive to suit even our princely shipowners; whilst I need scarcely add that "swamp mahogany," or, indeed, any of inferior quality would be highly unsafe, and, consequently, inadmissable for the "timbering" of a ship, however far it might be allowed for "inside" and "outside planking," &c. What the crown of Spain so wisely did in days of yore, has been, in my estimation, wisely imitated but a few years since by our own Government in the case of the Queen's beautiful steam-yacht the Victoria and Albert, which is, I believe, almost wholly constructed of choice mahogany, and may, with ordinary care, continue in existence long enough to carry in pleasure and in safety her Majesty's great-great-grandchildren.

In ships of war, it is evidently extremely desirable to attain the highest possible range of durability; for in the peculiar circumstances of ships built for the Crown and of those built for the Merchant Service, there is this wide difference, that the former know not Lloyd's or its underwriters, whereas, the latter must "live, move, and have their being" according to Lloyd's, or that great body would certainly not know them or insure them.

"Mahogany of hard texture" is, however, so far admitted in the construction of A 1 ships as to include beams and hooks, knees, rudder and windlass, main pieces, outside planking to light mark, and the whole of the inside planking.

As there is a pretty general misconception in respect to the specific gravity of this wood, I may observe that "superior northern Honduras" is as heavy as Travancore teak, and even heavier than Malabar teak, or English oak; the inferior qualities of mahogany alone being so very light and buoyant.

I should be very pleased to see good mahogany enter more largely than it now does into the construction of ships; but I am persuaded that its more extended employment must be regulated with judgment and discrimination. In fact the diverse requirements of a ship's timbering and planking always recal to my mind the combination of woods employed in the construction of a West Indian buggy or cabriolet, viz.:—Calabash for the naves of the wheels, brazilletta for spokes, casshaw (or acacia) for felloes, cedar for the body, and lancewood for the shafts. The aim of the shipowner is to obtain lightness, strength, and durability; but whether he attains that object by employing one description of timber, or by a judicious combination of two, three, or more woods, is more often decided by the state of the timber market, and the balance at his banker's, than by scientific reasoning or his own innate convictions.

It is the merchant-prince and great shipowner who can carry into effect the conceptions of his genius, and who launches upon the ocean those magnificent specimens of naval architecture which are remarkable alike for their size, strength, lightness, capacity, accommodation, symmetry, beauty, and speed.

Go to the great building-yards of our Brocklebanks, Greens, Smiths, Wigrams, Dunbars, and others of like stamp, and there we shall see and be able to understand how gloriously that happy combination of wealth, practical experience, and intellect, work, in maintaining the proud position of our mercantile marine.

As may well be supposed, the cost of first-class woods is high, and the supply is not at all times equal to the demand; it is desirable, therefore, to know how the supply can be largely increased, and the cost considerably diminished. It has been justly observed by Mr. Labouchere, that every British subject in the United Kingdom has a material interest in the cheapening of timber, and I think that the remark very forcibly applies even to ship-building timber alone. I will endeavour to show you how this cheapening may be effected by opening up new sources of supply, as well as by taking a greater advantage of those sources already open to us.

But previously to entering on that part of my subject, I must not omit to notice the silent but rapid revolution which is taking place in ship-building for the merchant-service.

This is not only in the increased and increasing proportion of iron used in the bracing, strengthening, and general framework of ships, but in the decided preference which even the most cautious men are gradually showing for ships built wholly of iron. Ships have been built comprising full fifty per cent. of iron, but such half-measures do not seem to satisfy the minds of men now.

Those very men, whose habitual caution and abhorrence of all innovations would have made them, but a few years ago, look with contemptuous pity upon the adventurous being who could be so deluded as to own an iron-built sailing ship; who regarded those sad fellows—the Scott Russells, the Ditchburns, the Mares, and others of that school—as being the mortal incarnations of the Tempter; yes, some of the self-same cautious, knowing gentlemen, no longer look with disfavour upon iron ships and their go-a-head projectors; but having fully digested that monstrous innovation, even permit themselves to contemplate the possibility of adding to it "auxiliary" power. And well it is for such men that they can be convinced; otherwise, in the great and eager race of competition, they would be left behind, and others—less cautious, less timid, but less prudent—would outstrip them.

The great cause of "iron versus wood" is not, however, yet gained; the triumph may still be long in coming! The disastrous influence of iron upon the compasses—the treacherous character of iron plates and iron rivets—the pertinacious partiality of barnacles for iron bottoms! All these still exercise great influence upon many minds; but last, and above all, it is not the habit of our sturdy, sure-going countrymen to make any great change in a hurry.

A good and successful commencement has nevertheless been made, the ball is in motion, and onward it must inevitably go.

I do not hesitate to declare my own full belief, that the compasses will traverse correctly,—that both plates and rivets will prove steadfast, firm, and faithful, and even that the "barnacles" may be effectually kept off—yet, I should not wish to see so great a change progress otherwise than calmly, carefully, and safely;—which it can only do under the guidance of further experience and the practical success of many years.

As I have expressed my belief in the undeniable suitability of iron ships for mercantile pursuits, I must at the same time state my opinion against them, if applied to warlike purposes.

Next to the entire non-existence of a navy, I can conceive nothing so perilous to the interest and safety of this country, as having our ships of war constructed of iron; nor can I, at present, conceive how the inventive faculties of man,—aided by all the science of the age,—can afford any adequate safeguard against the disastrous liabilities of a thin iron structure, such as a ship exposed on the ocean to the terrible effects of a cannonade.

It is quite probable, and indeed almost essential, that the partial use of iron in the construction of men-of-war, should be very largely extended, as it would add considerably to their strength, lightness, and internal dimensions, but, notwithstanding this increased and increasing employment of iron, I do not see any likelihood of the demand for ship-building timber abating for many years to come;—on the contrary, I fancy that I can distinctly foresee a very enormous increase for the purposes of our navy alone; not merely for the contemplated addition to and conversion of our war-ships, but for the continual building of new ones, to replace those which are now being converted into screw steamers.

I hold it as the inevitable result of such "conversion," that dry-rot will make swift havoc amongst them, unless the only preventive measures possible have been timely effected; but as I shall have to refer to this important point again, we will now return to the more immediate matter from which I digressed.

INCREASED SUPPLIES OF SHIP-BUILDING TIMBER.

It is not sufficient that we discover forests of timber, even of the finest quality; for before they can be turned to profitable account, we require a population to fell and trim the timber, a good shipping port, and the cheapest possible means of bringing the timber from its native forests down to the port of shipment.

But we require even more than this, in the majority of cases, viz., a climate, such as the European Superintendents can not only exist in, but be able to expose themselves in, with some degree of impunity. As a summary then, we may consider to be essential: 1. A tolerable climate; 2. Abundance of good timber; 3. A sufficient amount of cheap labor; 4. Numerous intersecting creeks and rivers to float down the timbers; and lastly a safe and eligible port for their shipment.

It is quite in vain for visionaries or enthusiasts to call attention to vast forests of stately timber, existing in regions where these essentials are not co-existing; for every man who has had any experience in such matters knows full well the numerous difficulties that beset the labours of timber-cutting gangs.

Leaving then all the beautiful and undoubtedly valuable woods which have their *habitat* in impracticable and impossible localities, I shall bring before you those that are easy of access, and that may be transported with facility to eligible sea-ports.

Confining myself to those woods which are, or which may yet become, first class on Lloyd's books, I will first present to your notice the extraordinary capabilities of Honduras.

Even before the time of the celebrated Dampier, the cutting of logwood and mahogany had become an important business in that colony. More than 180 years have since elapsed, and still it is almost wholly known to the world for its large exports of mahogany and logwood, and for these only!

During this long series of years, Honduras has had its organised bands of wood-cutters, whose peculiar occupation has descended from father to son through so many generations, that it has become a part and parcel of their very natures. From childhood to the grave, the sole business of their lives, is hunting for, and cutting timber in the dry season; floating it down to Belize during the rains; and enlivening that seething town with their fantastic dances and drunken revels, until their money being exhausted, they once more are obliged to betake themselves to their occupation in the dense forest. Hard and laborious indeed is their life in the bush; the felling and squaring up of the vast logs of mahogany being really the lightest portion of their task;—for they have to clear away the thick and thorny underwood, cut down and remove thousands of immense trees, in order to form roads, whereon their trucks can pass with their heavy loads to some creek or river. These main and bye roads, are often miles in length, all carefully graded and rendered complete by numerous temporary bridges, strongly constructed. To make these roads and bridges, a party of 50 to 60 men are detached; whilst the remaining number are preparing the mahogany for trucking.

Such gangs are usually provided with from 6 to 10 ponderous trucks, having 14 oxen to each truck; and as these work only at night by torchlight, we can readily imagine how carefully the roads must be cleared of all obstacles.

When the rains set in, and their logs are floating down towards the coast, these hardy fellows follow each batch in their little pitpans, and exercise all their amphibious dexterity in securing the safe and unimpeded passage of their property.

Now, I have not given you this slight sketch for the purpose of mere amusement, but because I wish in the most emphatic manner to point out the important fact that, in this colony of Honduras we have the largest and most practical body of tropical lumberers that exist on the face of the earth. That there is now exported from that colony about 25,000 tons of mahogany and about 6,000 tons of logwood per annum. That these woodsmen, in the pursuit of these two staple products, continually pass and repass vast quantities of fine and valuable timbers, in every way suitable for ship-building.

The forests in which they live and work contain some of the finest quality timber in the world, and that in extraordinary profusion. I do not pretend to know many of these woods, but the following I am well acquainted with: the greenheart, the live oak (*Bignonia*), and other oaks; the mahoe, the bullet tree, the Neesberry bullet tree, the iron wood, the locust (used for ships' planking and tree-nails), the dogwood, the red pine, the pitch pine, (much superior to that of Carolina and the other Southern States of America) the cedar (*Cedrela odorata*), a light and durable wood, not liable to dry rot nor subject to the attack of insects. The trunk of this tree is 70 to 80 feet long, with a diameter of from 4 to 7 feet

I am sure I need not dwell upon the great value of these fine timber woods, but I must again observe that there are numerous others perhaps equally valuable, which I cannot now enumerate. It is quite clear to my mind that the Honduras woodsmen could realise a very great deal more money, and with infinitely less labour, by preparing for market these timbers than they now do from their mahogany and logwood; but as the gangs are always hired under contract by some merchant or mercantile firm in Belize, it is evident that the initiative must be taken by those enterprising gentlemen. The safest course, perhaps, would be to commence the attempt by combining the two objects; for the same roads necessary for the trucking of mahogany would serve for the transport of the other timbers selected.

There is a distinguished member of this Society, Chief Justice Temple, still residing in Honduras, to whom we are all indebted for the indefatigable exertions he has made to attract attention to the capabilities and resources of this fine colony, and I am sure that his advice in relation to the course I have just suggested would be particularly valuable and instructive.

Guiana is another country from which we may reasonably anticipate a very much larger supply of timber than we now obtain. Already it furnishes two out of the eight first-class woods recognised by Lloyd's, viz, the mora and the greenheart; but there are in the country several other most valuable timber trees, such as the kakaralli, the locust, the cabacalli, the bullet tree, the sewari, the carana or red cedar, the kuraki, the determa, the cuamara or tonka, &c., &c.

If well-directed efforts were, however, made to increase the supply of the greenheart and the mora alone, immense quantities of both might be obtained. Greenheart is very abundant within 100 miles of the coast, and can be had almost to any extent, but the mora is even still more abundant. "This most majestic of all the forest trees of Guiana towers above every other, often attaining a height of from 100 to 150 feet, the lowest branches being 60 feet from the ground. The wood is extremely tough, close, and cross-grained, so that it is difficult to split, which renders it peculiarly adapted for ship-building. The trunk makes admirable keels, timbers, and beams, and the branches, having a natural crookedness of growth, are unsurpassed as knees. Were men-of-war ceiled with this wood, little mischief would be occasioned by splinters during action. In most respects it is superior to oak, particularly in its exemption from dry-rot. It is abundant along the rivers of the coast region, and extends as far south as lat. 3° N. It grows luxuriantly on sandy reefs, and on tracts of barren clay, known as 'Mora clay,' a soil so sterile as not to admit of profitable culture."

Sir R. Schomburgh, referring to this tree, says, "In all my former travels in Guiana I have nowhere seen trees of this description so gigantic as on the land adjoining the Berima at its upper course. On this upper part of the river the Mora is so abundant, and grows to such a size, that the whole British Navy might be reconstructed, merely from the trees which line its banks; a circumstance well worthy of consideration, for the river being navigable for vessels of 12 feet draught, those intended for the transport of the timber might load at the very spot where the trees are cut down."

There can be little doubt, then, that these two famous woods can be obtained in quantities limited only by the supply of labour that can be applied to this particular pursuit. Unfortunately labour is both scarce and expensive in Demerara, presenting an obstacle more difficult to surmount than may be imagined.

I am not quite sure that it would not be a good plan to induce the immigration of 100 Honduras wood-cutters, and establish them on some choice timber locality, so that whilst they are pursuing their accustomed labour, they might gradually draw around them those wild and adventurous spirits, who would prefer the excitement of such a life to the dull monotony of a sugar estate.

I do not believe that any great increase in the exports of timber can be anticipated from India Proper; but I think that the exertions of Government might induce a very large supply from Assam. I have in my possession various lists by Dr. Wallich, Mr. Masters, Major Hannay, and Mr. Martin, of the timber woods of Assam, amongst which we find a light and valuable kind of teak, the saul (*Shorea robusta*), the Dalbergia Sissoo, the oak, and numerous others most important and valuable. Assam has the most complete water carriage (the Calcutta steamer even going up to Gowhatti), and a population whose habits are well suited to such an employment as woodcutting; so that if proper measures were adopted, an immense quantity of first quality timber might be annually sent down from this rich country.

The Tenassarim provinces are perhaps more abounding in fine, valuable timber for shipbuilding than any other country in the East.

A quantity of teak has, for many years, been exported from Moulmain and other ports along the coast; but the field which this healthy and most pleasant country still presents is so inexhaustible, that I consider it to stand unrivalled as a timber-producing country. Hitherto teak alone has been exported, but there are others which are considered quite equal, and even superior to it. The following list of some of the best timber woods will serve to give an idea of the capabilities of these neglected provinces.

Anan.—One of the hardest and most compact woods known.

Ahnaun.—Strong and very durable; used in shipbuilding.

Keoun-lae (*Rottlera*).—Excellent for rudders.

Kat-wat-nu (*Cedrela*).—Large timber, 40 to 70 feet long, used for shipbuilding.

Ka-nyeng-kyaung-khyay.—For shipbuilding; contains an aromatic oil, and is not attacked by insects.

Kyep-yo.—Similar to teak.

Kud-doot-alain.—A large tree; used in shipbuilding.

Kunnazoo.—Very large tree; very hard and durable timber.

May-maka.—Used in shipbuilding.

May-rang.—Said to be very durable.

May-tobek.—Used for the bottoms of ships; considered preferable to teak.

Mayam.—An indestructible, strong, heavy, dark red wood.

Podauk.—A beautiful, compact and hard wood, sometimes called "Rosewood."

Pengadoh.—Strong and durable.

Pien-mahne.—Yields very strong knee timber.

Pyan-ga-dean.—Hard, dense, and durable; called "iron wood."

Soondra.—A very tough, elastic wood; said to be the strongest of all the Indian woods.

Thab-ban.—Fine solid timber, sometimes 70 ft. long; used for boats.

Than-kya.—A species of wood similar to saul.

Tha-nat.—A kind of grey teak.

Tha-nat.—More resembling saul.

Than-that.—A capital wood, like saul.

Theet-ya-han.—A species of teak—close grained.

Theng-gan.—(*Hopea Odorata*). An enormous tree, of the saul tribe; yields a strong, compact, and excellent timber, considered superior to teak—also a quantity of good dammer, or resin. Insects never attack this wood, nor is it liable to rot.

Tirbbac (*Quercus Amherstiana*) an oak; a large tree, used in boat-building.

Thounsanga.—A large tree, used in boat-building.

Thingan-kyaup.—Close grained, strong, heavy wood; used in ship-building.

Thubbae (*Mimusops*).—Used in ship-building.

Thuhbor (*Uvaria*).—A large tree, used in boat-building.

Toung-byeng.—A kind of red saul.

Thym-bro.—Good strong, durable wood; used in boat-building.

In this list I have mentioned but a few of the truly valuable timber woods abounding in the provinces of Amherst, Tavoy, and Mergui; and it must be understood that I have not included the well-known teak, which has so long been the grand staple product of the country, although enormous quantities of this celebrated wood yet remain.

Under the old system of the East India Company, the "rules and regulations" for teak cutting were stringent enough, but were rarely acted up to. Licenses were granted only on the conditions, first, that the selected trees were to be barked all round, so as to kill them, two years previous to their being felled, in order that only seasoned wood should be sent to market; and secondly, that for every tree cut down, another young teak tree should be planted carefully out, for the benefit of the country hereafter. I do not know whether these "rules" still continue in force.

It will be seen that timber cutting, therefore, has long formed one of the most important occupations of the people residing in Tenassarim, but we may go very much further than even the knowledge of this fact would lead us, inasmuch as we may view the Muggs, the Taliens, and the Burmese, as being all more or less expert in the use of the axe and the adze; as well as in the knowledge of the various qualities and uses of their forest trees.

There would be no difficulty, then, in organizing large bodies of these men, as "timber gangs," their wages being 10s. a month; but, as these provinces are scantily populated, any additional number of men might be procured (if necessary) either from among the Hill Coles, or from the adjoining territories of Siam, both of whom I have myself largely employed, and can vouch for their being excellent woodsmen. Under any circumstances, these labourers would not cost more than 12s. per month.

On the score of climate, it may be said that there is not a more healthy tropical climate in the world, both for natives and for Europeans. In fact, the late Dr. Helfer, Mr. Riley, and others, long resident in the country, have expressed themselves most enthusiastically in respect of it.

The three provinces are thoroughly intersected and opened up, by water communication, for the woodman, by the Great and the Little Tenassarim, the Tavoy, the Ye, the Attaran, the Gyne, the Houndran, the Lenya, the Pak Chan, and numerous other rivers and streams.

Along the banks of these rivers, vast quantities of timber exist, which with the greatest facility may be floated down to the sea.

Amherst offers a tolerable harbour for shipment. Below the town of Tavoy, (to the south of Crab Island,) the anchorage is good and safe in five fathoms of water. The port of Mergui does not itself possess the advantage of deep water, but the other mouths of the Great Tenassarim river are deep and safe; for instance, the Wayaungtaung has six fathoms, with a clear run to sea of not less than eleven fathoms. The Pak Chan has also excellent anchorage in from five to six fathoms.

Along this coast the rise and fall of the tide at full and change of the moon is 18 feet, offering not only great facilities for the egress of heavy laden vessels, but also for the launching of ships built in these provinces.

We find, then, in Tenassarim, combined in an eminent degree all the acquirements for the supply of cheap timber—an abundance of the finest wood—a really healthful climate—complete water communication—and good shipping ports.

In my remarks I have alluded only to the capabilities of the mainland; but it would be unpardonable to omit mentioning the fact that the numerous beautiful islands forming the Merguian Archipelago present advantages of the highest character, and contain harbours scarcely surpassed by any in the world.

Malacca (under which head I comprise our three settlements in the Straits of Malacca, viz., Pinang, Malacca, and Singapore) abounds in valuable timber woods, which are almost wholly unknown in Europe.

My friend Mr. J. W. Westerhout, the Assistant Resident of Malacca (where he was born, and has always lived), has furnished the following list of its principal timber woods:

Tampanees, Blean, Murbouw, Tamboosu, Tampang, Kalat Merah, Madang Katanahan, Natoo, Galam Tekoos, Madang Boagah, Rangas, Madang Konjeet, Madang Lawang, Lanioosoo, Madang Paranas, Madang Langadee, Rassaak, Madang Kawan, Madang Samenjaak, Saraya, Marantee, Lida Karabouw, Pisang Pisang, Mangaranan, Pataleng, Madang Taloor, Dalle Dallee, Baloon Ejook, Salomar, Bintangoor, Bonoot, Kampaas, Madang Kaladee, Jalootong, Giham, Paning Paning, Madang Tandook, Sagah, Panagah, Kalat Potee, Pannah, Marsanah, Kalat Lapies, Kledang, Tarantang, Pinang Bahie, Chengal, Brombong, Tolang Daheeng, Chechaar, Menkadoo Ootan, Golam Zekoos, Gombang, Kalaat Merah, and Maraboun Lahoot.

My own experience of these woods (during my residence in the Straits) was principally confined to the following, which I am able to describe and characterise:—

Murbouw.—Very strong, hard, and heavy; used in shipping; not attacked by insects; will last 100 years.

Bintangoor.—Valuable wood for ship-building, especially for planks, masts, spars, &c. It grows in great abundance, especially near Singapore, and is largely exported to Mauritius, California, &c.

Damerlaut.—Hard, tough, and very durable.

Giham.—A pale yellow wood, close-grained, hard, elastic, very durable, and generally used in boat-building.

Tampanee.—Used for house-building; hard, and exceedingly durable.

Tamboosu.—House beams; considered very durable.

Galam Tikoos.—Hard, tough, elastic; used in boats.

Marantee.—Very large; light resinous wood, much used for planking, and in building boats.

The Straits settlements of Malacca although near the equator, enjoy a healthful and salubrious climate, and have an abundant population of Malays and Chinese, whose wages average three to four dollars a month, without food.

The Malays are first-rate woodsmen and boatmen, admirably adapted for such work as procuring timber; whilst Chinamen are most industrious labourers, and extremely enterprising contractors, for all kinds of work. I consider this locality, therefore, as affording a promise of a very large supply of timber, immediately measures are taken to commence the undertaking, for the natives themselves will not be backward in entering into the spirit of the enterprise.

Australia is the next country to which I shall ask your attention, and which already furnishes us with "iron bark," one of Lloyd's first-class woods—a distinction we all thoroughly understand. This vast island is unfortunately extremely deficient in navigable rivers and in water communication generally, and whether this deficiency can in any manner be remedied by the formation of railroads or tramways intersecting the enormous forests of valuable timber that exist (not far inland), is an important question, now occupying the serious attention of very eminent and influential men in our metropolis, and which I shall have occasion to refer to again, although very briefly. Besides iron bark, the only Australian woods that have any classification at Lloyds' are the stringy bark and the blue gum, and these are in the fifth class. For a variety of reasons, however, I purpose confining myself entirely to the woods of Western Australia in its more southern parts. Those especially interesting to the shipbuilder are the tuart, the jarrah, the blue gum, and the morrell. The "tuart" is a noble timber tree, growing in tolerable abundance on the coast, particularly in the limestone districts. Planks are sometimes obtained ten feet wide, and it is said to be peculiarly adapted to the building of ships of war, as it is most difficult to split, and is not liable to splinter.

It is of a very pale yellow or white, and is sometimes called the white *Eucalyptus*. Its timber is curiously cross-grained, and it is hard, tough, and very strong and durable; from which known qualities it will no doubt attain a high rank at Lloyds', and will be very extensively employed in ship-building, provided it can be obtained in sufficient quantities.

The morrell is a large, fine, tree, yielding timbers three feet in width, which has been used as treenails, and may probably become more generally esteemed.

The blue gum (*Eucalyptus globulus*) is an enormous tree, sometimes yielding planks 14 feet wide and more than 120 feet long. It is beginning to be used pretty freely in ship-building, and will, I believe, when better known in England, obtain at Lloyds' a much higher classification than is at present accorded to it.

But it is the jarrah (another of the *Eucalyptus* tribe) that forces itself so prominently and so urgently upon our attention. It has been very generally called mahogany, because one or two of its varieties bear a resemblance to that wood when polished; but when spoken of in relation to ship-building, I should advise its own name being adhered to.

It is very certain that there are many varieties of the jarrah, just as there are of the teak and other woods; and, by bearing this in mind, we can easily reconcile all the apparently conflicting statements in regard to its colour, disposition of fibre, hardness, density, and specific gravity.

Mr. Reveley, an engineer to the Government, speaking on this point, says:—"First, in colour, there is every variety of shade, from almost crimson to reddish brown, and pale brown inclining to white. In the second place, as to grain, there is almost every variety, from the perfectly straight fibre to every species of curl, including the zebra and satin specimens. The length of the stem of this tree, taking the average, may be 65 feet (many being much longer), without a branch or a knot in all that length, and very nearly equal in size all the way up; being veritable ornaments of nature. It is not attacked by insects of any kind, nor has it any tendency to dry-rot, and is scarcely affected in any way by damp or moisture." The truthfulness of this description will be clear to those who will inspect the specimens on the table this evening.

There are forests of this wood (almost wholly) in Western Australia, of more than 4 miles in depth, which are known to extend for a length of 150 miles, covering an area of more than 364,000 acres, containing timber sufficient to build 20,000 line-of-battle ships!

A knowledge of these facts is enough to stimulate enterprising capitalists, especially as this wood is known to be a beautiful and a valuable furniture-wood.

Our merchant ships go out with emigrants and cargoes, but for a *return* cargo, they frequently wait and wait, and wait in vain; it would not be so if these vast forests could be opened up.

No wonder, then, that our enterprising merchants are turning their thoughts to this promising field of operations, and are seriously contemplating the construction of a short railroad (of eight to ten miles), to bring the timber to the shipping point. My own opinion is, that a company should be formed to carry out this important measure, and that Government should aid the undertaking by allotting to that company a sufficient number of selected "convicts" to work as labourers.

It has often struck me, that half the question as to the commercial success of the *Great Eastern* would be answered if she could always be sure of 10,000 to 15,000 tons of timber as freight on her passage from Australia; but within the last month or two I begin to fancy that she may, for the present, more likely be required to bring several brigades of our hot-blooded sepoys to Suez, for service on the shores of the Mediterranean: stranger things than this have happened before now.

In suggesting the means of obtaining larger supplies of ship-building timbers from the East and from Australia, I must make some few remarks on the subject of freight, which I know many might consider an insurmountable expense.

In reply to this, I would ask if ships do not take railway iron for 10s. a ton to India? Secondly, How much per ton on an average do ships obtain for dead weight from India, and how many wait there months for a return cargo, and, after all, come home only half-laden, or else have to run down to Arracan to load with rice for China in despair? On particular emergencies, when India is overwhelmed with shipping, as was but lately the case, ships have actually brought home sugars as low as five shillings per ton freight.

Recently a ship has taken a cargo of jarrah from Perth, in Western Australia, to Colombo, in Ceylon, at 45s. per load of 50 cubic feet freight; and, considering the number of vessels that require something in the shape of freight to pay their expenses homeward, I think that timber at 40s. would prove very acceptable in a majority of cases. On the other hand, I take it for granted that if timber cannot afford to pay at least 40s. per ton freight home, that such timber had better not be sent at all, and I entertain the idea that really good wood can legitimately bear this amount of freight.

The Preservation of Timber-built Ships.

In the former part of this paper I have already touched upon two subjects, which are both comprised in the one important question of preserving ships from the rapid decay to which they are now so liable. I have endeavoured to show where and how a far larger supply of the most durable timber may be had; but, after all, the fact remains patent, that even the best of woods when made into a ship will exhibit decay much sooner than they should do. And why is this the case? In my humble opinion, it is because ship-builders and ship-owners will not adopt the simple but efficacious means which chemical science, confirmed by ample experience, offers them. Long years of practical experiment has shown that timber, however prone to dry rot or to wet rot, may be effectually preserved from both by the use of certain metallic solutions or other suitable protective matters.

Amongst the many, one of the very best solutions for this purpose is that of sulphate of copper, which many years ago was patented by a Mr. Margary. Now this substance is sold, in quantities, at 4d. per lb. So that £100 would buy 6,000lbs., and each lb. weight is sufficient for six to eight gallons of water.

The process of saturation is a very simple one; the timber being placed in a closed iron vessel of great strength, is made to imbibe the solution by exhaustion and pressure, the operation occupying but a few minutes.

Timber so treated is rendered perfectly exempt from all liability to dry-rot; whilst other injections, such as paraffine oil, the commonest and cheapest naphtha and oil, with a little resinous matter dissolved and mixed with oil, will effectually prevent the decay from wet-rot, &c.

These are all such simple, well-known remedies, that almost everybody has heard of them; and yet it is positively true that neither the Admiralty nor the merchant ship-owner has yet built one single ship in which these principles have been intelligently and thoroughly carried out.

A reasoning and an undoubtedly shrewd man of business will have a fine ship built at a cost, perhaps, of £5,000; and yet he will not spend another £200 in rendering her timbers exempt from the attacks of insects and from rot.

But if this indifference be astounding in the merchant ship-owner, how shall we characterise such recklessness when exhibited in the construction of our men-of-war?

Whilst the ship is building it will not do to set boys with mops and brooms to sop the solution on her timbers. Such a mode of operation is not only wasteful and extravagant, but it is indeed playing "mops and brooms" with a very valuable, very beautiful, and very scientific process.

Whilst on this subject I must call attention to some fine specimens (now on the table) of the gigantic pine, which has recently been imported from Vancouver's Island, and to the following letter, which I received from the gentlemen who politely furnished me with those specimens. In this letter you will find that Messrs. Bilbe dwell upon the important circumstance of the gum or resin in these pines being "more uniformly diffused through the wood," thus tending to its impermeability and consequent preservation from decay. This is the chief object we should always strive to attain in treating timbers, with a view to their preservation :—

Nelson Dock, Rotherhithe, London, April 30, 1859.

SIR,—We have been informed that a specimen or two of the wood recently imported by us for mast-making purposes would be acceptable to you; we therefore beg to forward you a slice cut off the side, and a cube of six inches cut out of the heart of one of the masts made by us. From the slice you will find some of the gum exuding, which appears to us to be of a different nature and more uniformly diffused through the wood than in any other variety of pine known to us. It seems to render the tree almost impervious to water, as in dressing the masts they feel quite dry while being planed up, although floating a few hours before. In its growth this pine is remarkable for its straightness and the absence of knots and defects, and for its very gradual taper. In fact the trees grow *masts*, maintaining by nature that taper which experience has proved the best for masts. While all the pieces imported by us are remarkable, some few are extraordinary; one tree is 129 feet long and nearly 40 inches at one-third from its butt, without a blemish in it, and contains over 26 loads of timber. There was another, extraordinary in another way, its length being 118 feet 9 inches, whilst its diameter at the butt was only 15 inches and that at the top 6 inches. This was made into a flag-pole for Kew Gardens, but was unfortunately cut in two by a steamer, while it was entangled with Putney-bridge. * * * This pine grows in the Oregon and Washington territories, and in Vancouver's Island and British Columbia, where some of them acquire the height of 350 feet. It is, as you may suppose, a serious business to get them out of the woods to the waterside. Their importation into this country is a great boon to the Navy and Mercantile Marine. All those ship-owners who have had experience in the China trade, and in that to the north-west coast of America, can appreciate these mast-trees on account of their durability, which is scarcely inferior to that of teak. Those who have not that experience will, we hope, soon ascertain what is for their interest. Yellow pine, out of which masts of any size are usually made, is very perishable, its average durability being under five years, and when to the expense of renewing masts at short intervals, is added the expense of unrigging, taking out and in, and rigging again, besides the confusion and delay incurred therefrom, you will at once appreciate the value of these trees, if their average durability be only twice that of yellow pine. The writer has known them over ten years in a ship himself, and not a symptom of decay; and has been informed, among other instances of durability, that in one of the dock-yards a single bowsprit had worn out two frigates.—We are, Sir, your obedient servants,

THOS. BILBE and CO.

Leonard Wray, Esq.

Time will not permit me to enter more fully into this comprehensive subject of wood-preserving; but I must emphatically and respectfully warn our Admiralty to have every one of the sailing ships which are now being converted into screw steamers, as thoroughly saturated with the sulphate of copper solution as possible; especially in all those parts near the engines, boilers, and bunks. Let it be remembered that those ships were not intended for steamers when built, but that in opening them out for the purpose of lengthening them, opportunities will be afforded for using the preservative solution, which, as far as they are concerned, will never again occur. If this measure be not adopted I feel convinced that dry-rot will speedily destroy these ships, and many hundred thousands of pounds sterling will be lost to this country.

In conclusion, I beg leave very respectfully to suggest that the Council of this Society, in the interest of our naval and commercial marine, do address to her Majesty's Government a request that the Colonial Secretary shall order the several engineer officers residing in Honduras, Guiana, Assam, Tenasserim, Malacca, and Western Australia, to make a careful selection of the best and most durable timber woods of their respective localities, being not less than one or two tons of each timber, to season these lots in the most careful manner in the colony, and when fairly seasoned to send them home to the government dockyards, where they may be examined and tested by a commission composed of duly qualified men.

I believe that such a selection, so obtained, would prove of the utmost value to the government itself, as well as to the country at large, and I venture to think that the Committee of Lloyds' would also view it with great interest, and gladly facilitate the important objects in view.

Our numerous colonial territories possess vast forests abounding in the most durable timbers, which would be of the greatest value to our Royal Navy, and to the shipbuilding community of the United Kingdom, and it is a duty we owe both to those colonies and to this country, to develop their rich resources, and bring to light these almost hidden treasures.

In all such cases as this, there can be only one heart and one mind amongst Englishmen, who are always honourably anxious for the welfare of our country, and for the continued stability of our maritime pre-eminence.

DISCUSSION.

The CHAIRMAN said that in inviting discussion upon this subject, he was induced to offer one or two remarks, because Mr. Wray had noticed the apparently short period for which Lloyd's Register had given class A 1 to vessels built of the finest descriptions of wood, and he had mentioned the case of the *Gibraltar*, a vessel built entirely of mahogany, which lasted one hundred years. It was true that they assigned a period of twelve, thirteen, or fourteen years, to vessels built of the highest classes of wood; but they by no means limited it to any particular period, because, under certain inspection, vessels were entitled to carry that character a few years longer. But a ship was liable to certain vicissitudes to which other descriptions of buildings were not exposed. They might take the instance of Westminster Hall, in which the rafters had lasted for eight hundred years, and in many cases showed no evidence of decay; but it must be borne in mind that the timber in that instance was not subject to the vicissitudes of climate, or to the action of the weather. A ship was exposed to both of these; at one time she might be England, and in a few months in the tropics. These changes were severe trials to her timbers. Then again ships were subjected to variations in the cargoes they brought; and the want of proper ventilation was another source of dry rot and decay. In alluding to iron-built ships, he would observe that with regard to the large ocean-going steamers there would have been serious difficulty in supplying the enormous quantity of timber that would have been required for their construction, so that here the advantage of using iron was apparent. This material had been hitherto confined almost entirely to these steamers. There were not many instances of sailing vessels built of iron, while in the case of the larger steamers the exception was to find one built of timber. One objection to iron built vessels was that they were unsuited to certain descriptions of cargo. Sugar brought over in them was deteriorated, whilst guano acted injuriously upon the ships themselves. For many years to come, therefore, he thought they might look for a large demand for ship-building timber. He felt greatly indebted to Mr. Leonard Wray for having brought forward this subject; and, speaking on behalf of the society of Lloyd's Register, they would be happy to do anything in their power to further the objects proposed.

Mr. VARLEY called attention to various remedies for dry rot in timber, which during the last fifty years had been brought before the committees of the Society and duly recorded in their Transactions. He considered that in many instances the timber was half rotted by the process of seasoning. The whaling ships had been proved to outlast all others owing to the quantity of oil and salt with which the timber was penetrated.

Mr. E. J. REED, being called upon by the Chairman, said that, although in his judgment it was very undesirable in such discussions as the present, to pass by the main features of the paper read, and direct attention prominently to any incidental remarks which it might contain, yet as he was wholly unable either to add to, or to dispute, any of the leading statements contained in the very valuable paper to which they had listened, and as the author had devoted a paragraph or two to a subject on which he thought it highly desirable that something should be said, he would venture to invite the attention of the meeting for a very few minutes to the subject of iron ships. The author, in the earlier portion of his paper, had said:—"Next to the entire non-existence of a navy, I can conceive of nothing so perilous to the interest and safety of this country as having our ships of war constructed of iron. Nor can I, at present, conceive how the inventive faculties of man—aided by all the science of the age—can afford any adequate safeguard against the disastrous liabilities of a thin iron structure, such as a ship exposed on the ocean, to the terrible effects of a cannonade." However unfit the iron ships which had hitherto been constructed for war purposes might have proved, we were undoubtedly about to return to the use of iron in the construction of such vessels. It would be in the recollection of gentlemen present that nine or ten weeks ago Sir John Pakington announced in the House of Commons that, whatever might be their cost, we had no option but to commence the construction of iron-coated vessels. The reason alleged by him for this was two-fold; in the first place, he said, the experiments made with Sir William Armstrong's gun had shown that thick iron might be employed with advantage as a defence for the sides of ships; and in the second place the French had two ships thus defended fast approaching completion. Since that speech of Sir John Pakington's was made, a report made to the Treasury in January last had been received, from which he (Mr. Reed) derived the authority to state that the French were then actually preparing four of these iron-sided vessels. These vessels, it was stated, were to be substituted for line-of-battle ships. Their timbers (for they were built of wood) were of the scantling of a three-decker. They were to carry 36 heavy guns, most of them rifled 50-pounders, which would throw an 80-lb percussion shell. The Report stated that the naval men of France seemed to be so convinced of the irresistible qualities of these ships that they were of opinion that no more ships of the line would be laid down, and that in ten years that class of vessel would have become obselete. We had still further information to the effect that no less than eight of these ships were in contemplation by the French Emperor, the construction of six of them being fully determined upon. These vessels would not prove very efficient ships in many respects. With engines of 900 horse power only, they could not be very fast; nor could they be expected to prove very handy. But the important fact to be observed with reference to them was, that they might fairly be expected to be found proof to both Paixhans and Armstrong shells, and those present might judge for themselves what would be the effect of half-a-dozen shell-proof frigates making their appearance among a fleet of our wooden ships. In order to avert such a disaster as this Sir John Pakington had obtained a grant of money from the House of Commons to enable him to build a few shot-proof ships for our own Navy, and had called upon private ship-building firms, and also upon his own master shipwrights, to furnish designs for such vessels. As soon as these designs were received, if not before, it became perfectly evident that the most efficient method of constructing the shot-proof frigates would be to build them wholly of iron. This had been fully decided upon. He believed the main reason of this was to be found in the fact that it was not practicable to cover the whole of the exposed portion of the ship with thick iron, on account of the weight, and it would not of course do, in these days of explosive shells and liquid fires, to leave any portion of a wooden ship exposed. Consequently, the resort to iron alone became absolutely necessary. That the uncoated portions of the ship would be open to what Mr. Wray had denominated the "disastrous liabilities of a thin iron structure" was most certain; but the difficulty was got over by so proportioning the volumes of the defended and undefended portions of the vessel that, should the latter become riddled by shot and water-logged, the vessel would still be sufficiently buoyant to float, and maintain the action in which she happened to be engaged. He (Mr. Reed) was very sorry to say the Admiralty had lost time in proceeding with this great and most necessary undertaking. Sir John Pakington had promised the House of Commons that he would not lose a moment in bringing these ships into existence. But two months and more had passed since then, and yet no contract for building a single iron-coated ship had yet been issued. He feared they must impute to the extravagantly imaginative speech of Lord Clarence Paget a part of this delay, for the Admiralty departments had had much to do in the way of vindicating themselves from his unmerited attack. It took much time to go over the ten years' accounts of such a department as the Admiralty. Still, for his part, he thought delay on such grounds was scarcely justifiable. It would be better for such a speech to go unanswered altogether, than to withdraw our strength for months from an undertaking by which alone we could maintain an equality with France. In the hope that his words might find their way into the daily papers, and thus reach the eyes of our government, he had brought this subject to their attention. It appeared to him scarcely fair to this great iron ship-building country, to allow her to fall behind France in this matter.

Mr. P. L. Simmonds said, resuming the special consideration of the subject under the aspect in which it was regarded by his friend Mr. Wray, it was one of the highest moment to the country, and a more accurate knowledge of the available varieties and properties of woods suitable for ship-building, and, indeed, for other constructive purposes, was much to be desired. There was a great deal of miscellaneous information floating about, but very little reliable, respecting woods, although there were many small collections with meagre lists belonging thereto. Even with respect to most of the very woods ranked as first-class by the society over which the chairman presided, and largely used for ship-building, scarcely any information could be obtained. Knowing these facts, he had sent in to the secretary, for publication in the *Journal*, a few remarks upon them, supplementary to Mr. Wray's paper. The great difficulty in most collections of woods was the identification of the tree which produced the timber, and the attaching to the specimens the generic and specific name; for it might often happen that a useful wood, sent under some unknown native name from some country, might be more cheaply or extensively obtained in another locality. The numerous woods recommended by Mr. Wray, from his practical knowledge, as obtainable in the Tenassarim Provinces and about the Straits' Settlements fell under this category, that they were not scientifically named. He had frequently extensive collections of specimens of wood sent him by friends from different quarters, from Central America, from Brazil, Ceylon, and other localities, for his own private museum, which merely had local names; and in the absence of bark, leaves, or fruit, it was extremely difficult to refer these woods to their proper natural history classes. A friend of his, the late Mr. R. W. Nash, had introduced and called public attention some years ago to the very valuable woods of Western Australia, and had favoured him with specimens of those spoken so highly of by Mr. Wray. But the ship-builders seemed content to rest upon the woods they at present employed, until possibly, hereafter, greater scarcity of supply would lead to more inquiry into new fields. That our colonies and foreign possessions could supply abundance of fine and durable woods, whether in Honduras, Demerara and Berbice, Australia, Tasmania, New Zealand, Vancouver and British Columbia, there could be no doubt. The questions of labour and freight were the main impediments to the supply. It might, however, be possible to transport labour to the forests, and even shipwrights to the colonies to build the ships on the spot—for shipbuilding was now successfully carried on in India and New Zealand, as well as in our North American colonies—instead of having to bring the timber long distances to our building yards at home. It was very doubtful whether timber could be brought from the antipodes in any quantity at the freight named, and it was not every ship that was suited to carry timber. The vessels that went out with passengers and light goods to Australia and India were not very well adapted for bringing home balks of timber or spars. These, however, were matters for close and practical inquiry. The alleged difficulties of bringing Australian timber to the coast for shipment were no greater than, nor perhaps so great as, those already existing in Honduras, which Mr. Wray had detailed. If roads and bridges were made there, they could also be made in Western Australia and other of the Southern Colonies whence timber was to be shipped. Mr. Reveley and Chief Justice Temple, who had been alluded to, were both members of the Society, and would be able to furnish much practical information with respect to the timber in the districts to which their knowledge extended. Looking to the manifold uses of wood, the more such subjects were discussed the better. The Society had already done much good in the valuable information it had, during a long series of years, accumulated, in its Transactions and *Journal* on woods, and it was satisfactory to find it still devoting its energies to the diffusion of useful information.

Mr. Ditchburn said that the author of the paper doubted the sanity of any one who should attempt to question the excellence of *Lloyd's Register*. For his part, however, he begged to point out that that society was in no way an authorised or legal one. He believed the general impression was, that it was a legalised institution; but the fact was, it was a self-constituted body, which did as it pleased, and nobody was bold enough to find fault with it.

The Chairman said, the society alluded to rested upon public opinion, and by that it must stand or fall. He would add, that *Lloyd's Register* was not now upon its trial, neither was this the proper occasion for the discussion of its merits.

Mr. Ditchburn continued—Though a vessel was constructed of the best materials, if they were not properly put together she would be defective, and therefore the character of a vessel did not so much depend upon the materials used, as upon the way in which they were put together. Mr. Ditchburn was proceeding to argue that some of the regulations of Lloyd's, with reference to certain details in the construction of ships, were injurious, when

The Chairman said Mr. Ditchburn was mistaken in supposing these rules to be imperative, but as this was not an occasion on which he could undertake to defend the rules established by Lloyd's, he thought it better that this subject should not be proceeded with.

Mr. William Hawes was in hopes that Mr. Ditchburn would have grappled with another portion of the subject, viz., the preference which had been given to wood, as a material for ship-building, over iron. He believed it would very much tend to the benefit of our naval and mercantile marine, if, instead of directing attention to the means of preserving timber, which was always more or less liable to decay, they devoted an equal amount of attention to remedying the defects which prevented iron from being used for ships of war. They found that, with the ordnance at present in use, a shot could not only be sent through the hull of one vessel, but would penetrate through two vessels if they were alongside each other; and now it was a serious matter for consideration with what thickness of iron they could protect the ships and render them shot proof. He believed they must look to iron for safety, both for sailors and ships, and he thought greater benefit would accrue from directing attention, not to the means of protecting timber from decay, but of making iron ships safe. The chairman had told them that the large ocean-going steamers were constructed of iron, and the smaller ones of wood. He (Mr. Hawes) believed that they could not build a wooden ship with safety above a certain size. After all, a wooden ship was an aggregation of parts put together with wood and iron united—but which were not so united as to prevent play between the parts; whereas an iron ship was in fact a complete beam of iron from one end to the other—stronger where joined than in the middle of the perfect plate. If properly put together it was an absolute tube, which was the strongest form to resist pressure of all kinds; and the only difficulty was how to render the iron so strong as that it should be invulnerable to the ordnance brought against it. This difference being admitted, the reason was clear why large steamers were built of iron and not of wood. A steamer was subject to strains from which a sailing ship was free; and these were provided against in an iron ship by the perfect connection of all the parts. The objection that had been used against iron vessels—viz., that in one case a cargo such as sugar was injured, and in another case a cargo such as guano injured the vessel itself, was no doubt of some weight in reference to the mercantile marine, but he wished to dissent from that part of the paper which led them to believe that wood alone was the proper material for ships of war. He thought in seeking for fresh descriptions of wood for that purpose, they were throwing their time and attention away. They ought rather to hold out inducements to such ship-builders as Messrs. Ditchburn, Scott Russell, and others, to improve the iron ships, rather than to waste their time in searching for new descriptions of timber.

Mr. Weekes said, with regard to one of the objections to iron vessels, viz , the action upon the compass, he would observe that the accidents which had occurred to those ships had not arisen from the effect of the iron upon the compass, but from want of knowledge on the part of the commanders as to the real nature of that action. If the captain of a ship was acquainted with the principles of magnetic attraction, there was less fear of an iron vessel being in danger than a wooden one; because in a wooden one the action of the iron it might contain was less constant. In the merchant service examinations, it was to be regretted that no account was taken of the principles of magnetism. As far as the construction of ships of war was concerned, they had all along gone upon the policy of increasing their size to an extent which, in his opinion, was injudicious. He doubted whether they had not gone beyond the maximum size, and whether those now being constructed were not too large for warfare. He believed a large number of smaller ships would be more effective, such as those carrying one heavy gun, which raked fore and aft.

The Chairman thought these remarks were a little apar from the subject of the paper.

Mr. Mumford (one of Lloyd's surveyors) could not subscribe to the opinion given by Mr. Hawes, that the iron was stronger at the parts where it was joined than in the middle of a perfect plate. Experiments had proved that there was a great difference between the strength of the plate itself and the points of junction, which were generally the first to give way.

Mr. Leonard Wray, in reply upon the discussion, would say in the first place, with regard to the observations of Mr. Reed, that he (Mr. Wray) had most distinctly said that, for all mercantile purposes, he fully believed in the efficiency of iron ships. The ships which Mr. Reed alluded to were more of the character of floating batteries than ships. When they coated a wooden ship with enormous iron plates, they converted her into a floating battery. Mr. Simmonds had made an inquiry respecting the identification of these timber woods. This was a very pertinent question, for they all wished for some means whereby these woods might be accurately distinguished. Happily, upon this subject, he could refer them to two Museums, one at the India House, under the superintendence of a highly scientific man, Dr. Forbes Watson, who was always ready to afford information; and the other at the South Kensington Museum, to both of which institutions he took that opportunity of returning his grateful acknowledgments for the loan of most of the specimens exhibited in illustration of his paper. There was a difficulty surrounding the subject of the identification of East Indian woods, to which he might with propriety allude, as there was much to puzzle even men of research like Mr. Simmonds; that was, the peculiar manner in which the Tenassarim woods were named. The persons who sent these woods never thought of adhering to a single name, but they gave different names to the same wood. A person residing in one locality would attach to it a Siamese name, while in another locality a Burmese name would be employed. This was the case with some of the specimens now before them. At the Indian Museum, he (Mr. Wray) proposed to endeavour to remedy this in some measure by pointing out to Dr. Forbes Watson the exact character of each wood. The next point was that referred to by Mr. Hawes. He (Mr. Wray) thought he had already said enough to show that he did not intend to convey the idea that he was against iron ships as applied to mercantile shipping; but for warlike purposes, he repeated, he did not believe they were applicable; and he thought experience would ultimately prove it in the clearest, if not in the most disastrous manner. The gentleman who had spoken upon the subject of the compass had misapprehended the manner in which he (Mr. Wray) had alluded to it. He mentioned it merely as one of the old-fashioned ideas of the day—that the compass would not traverse correctly in iron ships; but having himself travelled many thousands of miles in iron vessels, it could not be imagined that he held to that notion. With regard to the size of our war ships, that was not a matter strictly pertinent to the present subject, but he thought small-sized vessels, with guns to fire rapidly, and with great effect, would be beneficial to the naval power of this country. With respect to the relative strength of the parts of an iron-built ship, he agreed with Mr. Mumford, that it was at the junctions the fractures might be looked for. He was, however, gratified to find that a plan of diagonal bracing of iron ships, introduced by Mr. Taylerson, was calculated to give great additional strength. He had no doubt that each successive day would bring forth some improvement which the inventive faculty of man would give to the public, whereby they might add, with increased safety, to our iron-built mercantile marine.

The CHAIRMAN moved a vote of thanks to Mr. Wray for his paper, which was unanimously passed.

The Paper was illustrated by specimens of various kinds of timber from different parts of the world, kindly lent from the Museum at the India House, the South Kensington Museum, and from the private collections of Mr. John Allen, and Messrs. Bilbe and Co.

The Secretary announced that on Wednesday evening next, the 11th May, a paper, "On the Recognition of Music among the Arts," by Mr. Henry F. Chorley, would be read.

The following letters have been received since the meeting :—

SIR,—Information connected with the various colonial and foreign woods, their properties and uses, is of the highest importance to this and other countries, whether it be for ship and boat building, furniture solid or veneered, house-building, or the more ordinary carpentering purposes, carriages, implements, and the thousand and one uses to which wood of different kinds is applied. I have from time to time kept my attention directed to this subject, and have endeavoured to diffuse, through the means of the different publications I am identified with, some little practical information on the subject. But an individual, unless supported by Government influence or other resources than private means, can do little in this matter from the limited funds at his command, the time required for research, the expense of publication, and the comparatively small circle of persons specially interested in the fruits of these researches. The Society of Arts has already done much in this wide field, by the collection of information and specimens of wood, and there are now several other labourers in the field accumulating information which will, no doubt, be eminently useful. There are at present very fair collections of foreign woods at the Crystal Palace, the East India Museum, South Kensington, and Kew. There is a small collection at the Admiralty, Somerset-house, which ought to be much enlarged and better known. I am not aware what collection Lloyd's has, but Mr. W. W. Saunders, one of the Committee of Management, and a member of our Society, has a large and well-named private collection. The necessity for some public information on the principal woods is the more necessary, since there are some selected and approved by Lloyd's Committee, of which little or nothing is really known out of the circle of a few shipbuilders.

The importance of a correct knowledge of the qualities of the woods now used or available for ship-building to a maritime nation like Great Britain, no one will deny. We cannot always be restricted to the limits prescribed by Lloyd's, for as some become scarce or unattainable, others must take their place. Very good ships are now launched in North America, India, and the Baltic, although they may not be equal in durability to those built under the superintendence of Lloyd's surveyors, nor are the shipwrights there restricted to the woods which are considered the *sine qua non* to entitle vessels to take rank for insurance under certain grades.

I think it may be well to pass under notice the chief woods bearing a high character with the Committee of Lloyd's register.

Of the English oak little need be said.

The African oak is not an oak at all, but sometimes termed teak, and is the produce of *Oldfieldia Africana*. The imports of late years from Sierra Leone have been declining. In 1841 we received 13,127 loads. In 1853, 1854, and 1855, the imports exceeded 7,000 loads per annum, but since then they have been less than 5,000 loads. As it is now obtained from the interior, every succeeding year it is becoming more scarce. The oaks of America are generally very strong, but some of them are cross-grained and liable to warp and crack under changes from moisture to dryness. That principally used for ship-building, and reckoned a first-class wood by Lloyd's is the live oak (*Quercus virens*), the hardest and densest of the genus. It grows in the Southern States near the sea; and the sea air seems necessary to its existence, as it is rarely found more than fifteen or twenty miles in the interior. The rings of annual growth are very faint, adding to the density of the fibres; the medullary rays are very distinct, traversing in strong pale lines the faint waves of annual growth. In the United States Navy, all the frames and principal pieces are made of it; vessels built with oak, cut on the coast of Georgia, thirty years ago, are now in excellent condition.

Looking at the immense mercantile tonnage of the United States, which equals, if it does not exceed our own marine, it would be desirable to ascertain the character and proportion of the wood used in the construction, and the duration of the vessels, under the more free system of building which prevails there.

American white oak (*Quercus alba*) has not a very good reputation in England, for the reason that the wood generally introduced here is from Canada, and this is never used in America except for inferior purposes. The white oak from the sea-board of the Middle and Southern States is equal to the best foreign timber, and is used for keels, side-timbers, and planks of vessels, and other purposes requiring great strength. It is allowed in the eight years classification of Lloyd's.

The American larch called Hackmatack and Tamarack (*Larix Americana*), is a very heavy, compact, strong, and durable wood, surpassed only by the oak. It is much used in ship building, especially for knees and beams, and will outlast even oak itself. It is so compact as to be nearly incombustible, unless splintered. It is only admitted by Lloyd's to the seven years classification of ships, and the committee seem not to be aware that the two names are applied to one and the same wood. There is also some confusion about the cedars recognised by Lloyd's, which is the "red cedar," and which the pencil cedar. The red cedar of America is the *Juniperus virginiana*, and the same name is given to the *Juniperus Bermudiana;* both are used for making pencils. Surely, therefore, some more broad distinction for the guidance of shipbuilders should be given, for the pencil cedar classes ten years, and the red cedar but nine years. So with the term juniper, what wood is intended by this. The red cedar of the United States is remarkable for the durability of its wood, the agreeable aromatic odour preventing the attack of insects. It is highly esteemed by ship and boat-builders.

For the purpose of ship-building, teak is well-known to be a rival to English oak, and superior to it in some of its properties. Its durability under exposure to all varieties of climates is perhaps unrivalled, for ships constructed of it have been known to sustain a degree of service which would have knocked up any other vessel. It is also more free from the gallic acid which causes oak to corrode iron and attract worms.

Our supplies of this useful wood are rather on the increase, for we received in 1857, 26,748 loads from India, a considerable excess over any former year. The *Morung Saul* of Lloyd's is difficult to identify, being merely a variety of the *Shorea robusta.* This is unquestionably the most useful known Indian timber for engineering purposes, and is now much used there for railway sleepers. It is not however suited for planks, as it twists, shrinks, and warps, whenever the surface is removed, even after many years seasoning. From some experiments made in India, it appears that, compared with teak, its strength is about 1,121 to 869. Major H. Campbell found that unseasoned saul broke with a weight of 1,308lbs., seasoned saul, with 1,319lbs., and teak with 1,091lbs.

The greenheart of Demerara (*Nectandra Rodiœi*) is a fine grained hard wood, well adapted for the planking of vessels, and being well suited for resisting tensile and compressive strains, is used for the keelsons of ships and beams of all kinds. The black greenheart is considered more durable than the common greenheart.

The mora is another valuable South American wood, obtained from the *Mora excelsa*, a tree which in Guiana frequently reaches 100 feet in height or upwards. It is tough, close, and cross-grained, and is peculiarly adapted for ships' timbers and planks, for which purpose it is extensively used, and reckoned as one of the first-class woods by Lloyd's.

The iron bark of Australia is the produce of several undefined species of *Eucalyptus*, which supply first-rate durable timber; but the timber, I believe, is often confounded with the blue gum obtained from other species of the same family of trees. These are the eight principal woods recognised by Lloyd's for the floors, futtocks, toptimbers, keelsons, and stern posts, &c., of ships.

Among other second-class recognised woods are the Sabuca of Cuba, the produce of *Acacia formosa.* This is a hard and tough wood, of a dull red colour, and close short grain. It is an excellent wood for beams and planking in ships, and is much approved in the Government dockyards. It was used for the steps in the Crystal Palace in Hyde-park, and the same steps are still in use at Sydenham, without any evident signs of wear.

Angelly is a Cochin wood, the produce of *Artocarpus hirsuta.* Venatica I do not know, nor can I find any reference to it, even in the collection of woods named in the Jury Reports of the 1851 Exhibition, nor in any of the few works treating of woods. It therefore proves the want of a handbook of reference on the various woods, and their special qualities and uses.

The tonnage built and owned on the other side of the Atlantic has gone on increasing largely for many years past, and some very fine clipper vessels have been launched, which, for strength and sea-worthiness, will equal any turned out of our building yards.

Capt. De Belveze, of the French Navy, in a recent report to his Government, states—"I visited some of the shipyards of Quebec, and had conversations with several of the builders. Oak, elm, and cherry, for the planks of the 'live' works; red and white pine, for the planks of the 'dead' works; oak, elm, and tamarac, for the knees; and beech for the ribs; these are the kinds of timber most employed. Mr. Gilmour, the most extensive ship builder in Quebec, does not think that planking and lengths being made of resinous timber would shorten the duration of the vessels, and he observed to me, what was confirmed by other builders, that the tamarac was not subject to dry rot, and was substituted with very great advantage for oak in the knees. He has constructed, in this manner, more than a hundred ships, of from 1,000 to 1,500 tons, which have all done very satisfactory service."

I am, &c.,
P. L. SIMMONDS.

8, Winchester-street,
Pimlico, May 4, 1859.

Sir,—Having attended the meetings of the Society of Arts by permission of a member, I had much pleasure in listening to the able paper by Mr. Leonard Wray, read last evening.

Had I been aware at the time that other than members were permitted to take part in the discussion, I should have undoubtedly asked one or two questions; for, valuable as the paper was as to pointing to sources of supply of timber, as one who has worked many hard woods at present imported into this country, and who knows the difficulties which attend the working of others, it appears to me that capitalists should not be misled. Mr. Wray spoke of several gigantic trees, some yielding planks 14 ft. broad. He also called special attention to the Jarrah, a wood of great beauty and density. Now both measurement and density involve fitness of tools to cut and prepare the timber for shipment; and, as far as I know, a modification in the form of our present tools, in order that we may work these woods economically, would be required. It appears to me that unless Mr. Wray is aware that such modified cutting-tools have been prepared, so as to enable the woods he points out to be worked economically, merchants and traders will be misled by the examination of mere museum specimens; and should they import them, unless they are capable of being worked with existing tools, it is needless to say that there would be great difficulty in finding a ready and remunerative sale for them. Possibly, Mr. Wray can point out the peculiarities in the methods employed by the cutters of India, Honduras, and Australia, and the instruments used; by so doing he will add to the obligation he has already conferred in contributing so valuable an amount of matter through your Society to the public. If tools have to be invented, and exported to foreign countries to work the woods, this will, I fear, add much to their first cost, and tend to impede their introduction into this country.

I am, &c.,
J. G. HOWARD.

Bow, May 5, 1859.

WATER GAS.

The production of hydrogen gas by the decomposition of water is well-known, but for illuminating purposes it is equally well-known that the flame from pure hydrogen alone is worthless, though for heating stoves it has been successfully applied. When jets of lighted hydrogen are made to burn in a grate filled with loose fragments of platinum foil, a very cheerful-looking fire is produced, and this is well-known to the public under the name of Bachhoffner's Polytechnic fire, from its frequent exhibition a few years since at the Polytechnic Institution, by Dr. Bachhoffner. Hitherto the expense of producing hydrogen gas for heating purposes, has prevented its being manufactured on a large scale. Many patents have, however, been taken out during the last few years, for producing hydrogen gas from water, and bringing it into combination with rich gases derived from oil, resin, tar, naphtha, Cannel coal, and other materials, yielding highly illuminating gases. Among those who have been working in this direction, and have taken out patents for effecting the purpose, may be may be named, Donovan, Louz, Manby, Val Marino, Radley, White, Croll, Webster, Barlow, Gore, &c. The processes described by these gentlemen do not differ greatly, but almost the only one which appears to have been carried out practically on any tolerably large scale, is that of Mr. White, under whose patent several towns in the north, and factories in Lancashire, have been lighted with gas manufactured from water, combined with the gas from resin or Cannel coal.

Some small works have been erected at St. Ives, on Mr. Webster's patent. Dr. Frankland, at Manchester, made a large number of experiments in reference to this gas on works erected by Mr. White, at the mills of Messrs. Clarke and Co., with a view to ascertaining its illuminating power and its cost as compared with that derived from coal. The result of these experiments was in favour of the water gas, both as to illuminating power and cost. Notwithstanding this, from some cause or other, its use has not extended.

It is unnecessary now to say more in reference to this mode of utilising for illuminating purposes the hydrogen gas derived from water, as the object is now to call attention to a mode of producing hydrogen gas from the decomposition of water, rendering it applicable for illuminating purposes without combining it with the gases from resin, Cannel coal, and other substances. Mons. Gillard, some years since, turned his attention in this direction, and took out patents for obtaining hydrogen from water, which he used both for heating and illuminating purposes, the light being produced by burning the hydrogen beneath a cap of platinum wire, which thus heated to incandescence, gave a brilliant light. M. Gillard has since been engaged in perfecting his invention, and has lately taken out patents for his improvements. He has erected some small works at Highgate, where the the process is now carried out, and some of the public lamps in the neighbourhood are lighted on this principle. The method adopted at the works is as follows:—Steam from a boiler is carried through pipes, in which it becomes superheated, whence it is carried into iron D retorts, and dispersed over layers of incandescent charcoal by means of a number of small orifices in tubes running through the length of the retorts. The object is to disperse this superheated steam in as finely divided a state as possible over the heated charcoal. The gas thus produced, after passing the hydraulic main, is conducted through the condensers into a lesser purifier, where it becomes deprived of its carbonic acid, and enters the gas-holder for distribution as nearly pure hydrogen. In this state it may be used for heating purposes, but for illumination the gas is made to pass through an argand burner, with more numerous and smaller holes than are ordinarily used for other gas. This burner is surmounted by a cage or net-work of moderately fine platinum wire, fitted to it in such a manner as to stand a little above the dull flame of the hydrogen. This cage of platinum, as soon as the gas is lighted, is converted into a cylinder of intense white light over the surface of the platinum. The light is stated to be perfectly pure, and from the nature of the arrangement is necessarily steady. The inventor states that the gas can be manufactured at a less price than that from coal, and the small amount of platinum used for the burner adds but little to its cost. The City of Narbonne is lighted with this gas, and M. Gillard is under contract for three years to supply the public lights there, about five hundred in number.

Home Correspondence.

TRADE MARKS.

Sir,—Allow me to call your attention to the annexed paragraph, from the second report of the Commissioners of Her Majesty's Customs, commenting on the objectionable practice of importing foreign goods with British marks, which bears so directly on, and illustrates so forcibly, the paper on "Trade Marks" which I had the honour to read to the Society. I am, &c.,

LEONE LEVI.

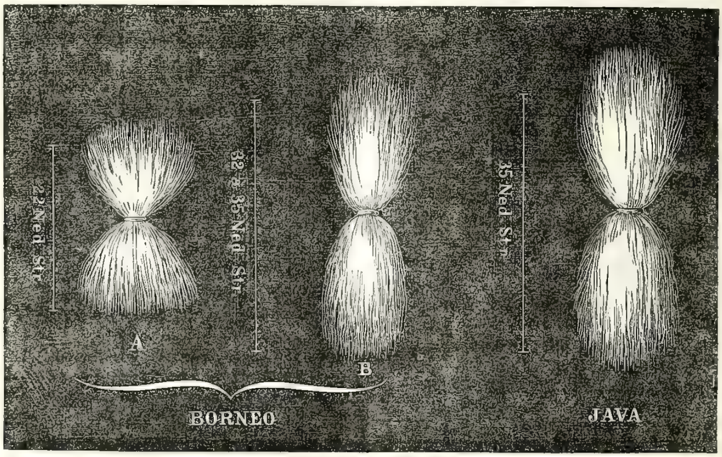
20, Thornhill-crescent, 26th April, 1859.

"It may perhaps be desirable to call your lordships' attention to the increase of a practice which has prevailed to some extent for several years—the importation, or attempted importation, of articles manufactured abroad, but purporting to be British, which, by a strict intrepretation of the law, would be altogether prohibited. In dealing with these cases, our principle hitherto has been simple and uniform, and, we believe, just. The law cannot, either by sanction or connivance, permit itself knowingly to be made a party to a fraudulent transaction, whether the fraud be perpetrated merely on the general public, or on an individual manufacturer as well. When, therefore, dutiable articles are imported bearing marks, brands, or words obviously designed to give them a British character, and to deceive the purchaser into the belief that they are of home production, we decline to admit them to entry, and require them to be returned to the port of shipment, except when neutralised by the introduction of a foreign word. In those graver cases where the articles bear in addition the actual name of existing and well-known British manufacturers of similar goods, we confiscate and destroy them, because the fraud admits of no excuse, and approaches to the character of forgery. Thus, a knife stamped 'Cast Steel, Nuremberg,' would be admitted to entry, because the English words are held to be descriptive only, and to be neutralised and rendered innocent by the accompanying foreign name,—'Nuremberg;' but a knife marked 'V.R., Sheffield,' with a crown, would be sent back to the port of shipment, because, while actually of foreign make, it distinctly purports to be of British origin. And, further, a knife bearing the brand 'Rogers, Sheffield,' would be confiscated and destroyed, as being undeniably designed at once to cheat the purchaser, and to injure the individual whose name it falsely assumes.

"It has, however, of late years been by no means uncommon among British manufacturers, especially producers of clocks, watches, pencils, steam gauges, and various articles of glass, to get their articles made abroad, where labour is cheaper than in this country, and to import them stamped with their own names or distinguishing brand. In these cases the articles are admitted to duty on the application and declaration of the manufacturer. This practice seems greatly on the increase. The instances of it on the part of London alone stood, in 1855, 28, in 1856, 109, and in 1857, 195. In the outports during the past year the instances of similar importation were 150. We do not wish to offer any opinion either as to the practice itself or the continuance of the Treasury order which permits it. We merely desire to signalise its increase to your lordships, and to suggest for your consideration whether the British manufacturer is not thus enabled himself to practice a fraud upon the purchaser analogous to that from which the law protects him when meditated by others. At all events, it seems right that the public should be made aware that the fact of any article bearing a British maker's name no longer affords any security that it is actually of British workmanship."

COTTON IN INDIA.

Sir,—I read with very much satisfaction the paper of Dr. F. Forbes Watson, "On the Growth of Cotton in India." I beg to offer you the drawings of some cotton-samples from our possessions in India, to prove how the staple of Indian cotton could be improved. The sample A is the native cotton from Bangermassing, in Borneo, natural size; B, the staple of cotton cultivated at Mocara Enim, in Borneo, from seed originally Georgia Sea Island, but from the Algerian crop, similar to what was exhibited at Paris in 1855. The other is from the same Algerian origin, cultivated at Buitenzong, in Java. The measure indicated is in millimètres, being 25·4 = one English inch.—I am, &c.,



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Delft, Holland.

FREE LIBRARIES.

Sir,—I have read the various letters by Mr. Blake upon "The Society of Arts Examinations," and agreeing with him in some things, and differing in others, saw no reason for interference whilst the letters were confined to their professed object. But when Mr. Blake assails "Free Circulating Libraries," and treats us over again to the old voluntary educationists' arguments, it is time for the suggester of the first Free Circulating Library in England to speak.

I venture to affirm (prior to any specific inquiry) that although we have in this city one central library, with about 35,000 volumes, and several branch establishments, no one of our public educational institutions has decreased in members thereby; whilst the reference departments are fountains, from which the popular writer draws a perrennial supply for the people.

I do not mean to say that there are no borrowers who can afford to pay; but I am certain that great numbers are induced to read good books, who otherwise (if they read at all) would spend their time over the veriest trash; and that working men when out of employ, and with no money to spare, may and do find improving occupation for their leisure, without money and without price.

A taste is by this means created for systematic instruction, which returning prosperity enables the working men to gratify at the Mechanics' or other educational institution.

The tale about the Sheffield Mechanics' Institute would have been startling, had its decline dated simply from the establishment of the "Free Library," but unfortunately, both for Sheffield and the argument, it is much older, and, as I believe, is due entirely to other causes.

The assertion that people value things according to their direct money cost is not true, for what holds so high a place in our estimation as a token of affection or gratitude, even though it would not sell for a shilling. Does the boarding school pupil, at a hundred guineas per annum, value his instruction more than the charity school-boy does that which is the gift of a man who returned to earth about three centuries ago? I affirm, not a whit more.

We have a "model secular school" in this city, the qualification for admission to which is, entire inability to pay anything, and the discipline of that school is as perfect as I ever saw; whilst the attendance is more regular, and extends over a longer period than at any of the working class pay schools.

But even if there was any value in Mr. Blake's argument in this matter, it would not apply to Free Libraries, for where people are taxed for a public institution, they feel that they do pay for it, and therefore ought to value it, whether they do so or not. If this position be not tenable, and as Mr. Blake says, that people value a thing according to the price, how comes he to assert that a Free Library (wanting in this very element of direct cost) injures a Mechanics' Institution, where the members have to pay? And how highly we ought to value an expensive government, and how forcibly to denounce economy.

I am, &c.,

JOHN WATTS.

Whitmore-house, Old Trafford, Manchester, April 20.

Proceedings of Institutions.

Chelmsford Literary and Mechanics' Institute.—The annual meeting of this Institution was held in the Lecture Hall, on the 4th inst., Whitbread Tomson, Esq., the treasurer, in the chair. From the Annual Report and Financial Statement, which was read by Mr. Hair, the hon. secretary, it appeared that the Institution was in a greatly improved condition. The number of members was as follows:—Honorary 25; ordinary 630;—Total 655. The report referred to a handsome donation by Bingfield Baker, Esq., M.P., of £10. 120 volumes had been added to the Library during the past year, making the total number 2420. The average monthly issue of books had greatly increased, amounting to 810 volumes. No alterations had been made in the supply of newspapers and periodical literature, with the exception of the changes made at the last annual meeting, and which have resulted in a saving of £7. The Committee believed their arrangements in the Lecture department had been successful—16 Lectures had been given during the course, and the attendance had never been surpassed. The net cost of the lectures had been £28 2s. 6d. and the Committee appended a statement of the net cost of the last 6 years, to enable the members to judge how far they had endeavoured to secure good lectures at a reasonable expense, showing that the expenses of the last year had been considerably less than for many years past. The drawing class, under the direction of Mr.

Brown, maintained its accustomed reputation. Two prizes had been awarded by Mr. Chancellor and Mr. Moss, and the result of the competition was highly satisfactory. Similar prizes will be again offered, with the addition of one by Mr. hurch. The singing class recently formed, numbering 2 members, was progressing favourably. A class had been formed for the study of Botany, under the superintendence of Mr. John Gibbs, and it is probable that one of the class will offer himself for examination by the Society of Arts. In concluding their Report the Committee drew the attention of the members to the importance of forming additional classes for instruction in the various branches of Science and Art, and urged upon them not to rest satisfied with merely electing a Committee of Management, but to take individually a more active part in promoting the well-being and furthering the objects of the Institution; and believing that the Institution is based upon sound principles, and has already been the means of providing instruction and healthy amusement for a large class of the community, so will it be aided by the exertions of the members calculated to exercise a continually growing and more powerful influence in the cause of education, and on the moral well-being of the locality. The Chairman, in moving the adoption of the report, congratulated the members on the highly satisfactory state of the Institution. Mr. B. Bryant seconded the motion. The election of officers for the ensuing year then took place, and a motion for opening a subscription for presenting the secretary with a testimonial was unanimously carried. Votes of thanks were then passed to the committee and officers for their services during the past year, and the proceedings closed with a vote of thanks to the chairman.

Darlington Mechanics' Institution.—In the report for the past year, which was presented at the Annual General Meeting, held on the 11th March, the committee are glad to be able to state that, though no peculiar features of success or encouragement have attended their labours, the various objects of the Institute have been conducted with steadiness and efficiency. The penny bank continues to progress, and gratifying evidences have been afforded of its usefulness. The profits for the past year have been £9 14, and for this handsome addition to the funds the committee are indebted more especially to the secretary and to the cashiers, who have conducted the Bank's numerous transactions. The library has not received so large an addition of new books as the committee would have wished, but owing to the accumulation of periodicals for the two previous years, and the unavoidable deterioration of books in constant use, a considerable sum has been expended in binding and repairs. The total number of books belonging to the institute is 2,613; the issue has been 9,951 against 10,256 in the preceding year, showing a decrease of 325. 21 books have been kindly presented. A new catalogue has been printed. Shelves have been erected for the specifications of patents, which were presented to the Institution about two years ago. The classes have received the attention which their importance deserves. A class for elementary instruction in writing, arithmetic, &c., has been regularly conducted on four evenings of the week by Mr. G. W. Bartlett, with an average attendance of 23 scholars. Mr. William Jones has again kindly undertaken the care of a German class. The superior advantages presented by the Central School of Art having led to the withdrawal of many of the pupils connected with the drawing class, it has now been suspended. Several lectures have been delivered during the session. The soiree held in November last added £8 11s. 11d. to the funds of the institute. The present number of members is 524, being 29 more than last year. The committee record, with deep regret, the death of John Church Backhouse, Esq., who, for many years, held the office of treasurer to this Institution, and took a warm personal interest in its formation. In conclusion, the committee urge upon their fellow members the importance of another spirited effort to remove the debt of £306 14s. 4d. still remaining on the building.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
London Inst., 7. Mr. G. W. Hastings, "On Commercial Law, in connection with the Travers Testimonial Fund."
Geographical, 8½. 1. Major Stokes, "Notes on the Lower Danube;" 2. Mr. J. McQueen, "Observations on the Geography of Central Africa;" 3. Mr. Lyons McLeod, "Remarks on the *Seychelles*."
Tues. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Syro-Egyptian, 7½. Mr. E. Harle, "On the history of Sennacherib; with some fac-simile drawings of the destruction of the Lachish of the Bible, taken from the slabs in the British Museum."
Civil Engineers', 8. 1. Discussion on Mr. Kingsbury's paper "On the Victoria Docks," and upon Mr. Harrison's paper "On the Tyne Docks." 2. Mr. W. Fairbairn, "A Short Account of the Wrought-iron Girder Bridge over the Spey, on the Aberdeen and Inverness Railway." 3. Mr. C. E. Amos, "Description of the Government Waterworks, Trafalgar-square."
Medical and Chirurg., 8½.
Zoological, 9.
Wed. ......Literary Fund, 3.
Society of Arts, 8. Mr. Henry F. Chorley, "On the Recognition of Music among the Arts."
Graphic, 8.
R. Soc, Literature, 8½.
Archæological Assoc. 8½.
Thurs .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Royal Soc. Club, 6.
Antiquaries, 8.
Philological, 8.
Royal, 8½.
Fri. ......Astronomical, 8.
Royal Inst., 8½. Mr. W. Hopkins, "On the Change of Terrestrial Temperature at different Geological Epochs."
Sat..........Asiatic, 2.
Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 6th April, 1859.

140. (1). Electors—Return.
168. Queen's Colleges (Ireland)—Returns.
170. Literary, &c., Institutions—Return.
178. Belfast Lunatic Asylum—Return.
179. Exchequer Bonds—Account.
181. Navy Estimates—Sums required to be voted on account.
181. Army Estimates ,, ,, ,,
185. Revenue Departments Estimates ,, ,,
186. Civil Services Estimates ,, ,,

Delivered on 7th April, 1859.

193. Army—Supplemental Estimate.
182. Navy Estimates (1852-58)—Copy of Report.

Delivered on 8th April, 1859.

133. East India (Mutiny)—Return.
160. Hull Citadel—Return.
99. Bills—Railway Tickets Transfer.
100. ,, Westminster New Bridge.
101. ,, Local Government Supplemental.
102. ,, Pauper Maintenance Act Continuance.
"Charles et Georges"—Further Paper.

Delivered on 9th and 11th April, 1859.

50. Local Acts (49. Isle of Wight Ferry Company)—Admiralty Report
174. Brewers, &c.—Account
175. Hops—Account.
180. Navy (Alteration of Ships, &c.)—Copy of Report.
187. East India—Copies of Financial Despatches.
191. Military Savings Banks—Accounts.
192. Lord's Day Observance Act (Southampton)—Return.

PATENT LAW AMENDMENT ACT.

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APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, April* 29, 1859.]

Dated 7th April, 1859.

865. D. Moseley, Chapel Field Works, Ardwick, Manchester—Imp. in the manufacture of cards for carding cotton and other fibrous materials.
867. R. Postlethwaite, Liverpool—An imp. in harness pads for horses.
869. G. Champney, Halsham, Yorkshire—Imp. in reaping machines.
871. J. Garrett, Arundel-place, Haymarket—Imp. in the construction of goblets, jugs, and other like articles.

Dated 8th April, 1859.

873. J. T. Pitman, 67, Gracechurch-street, London—Imp. in the construction and use of fireworks for signals. (A com.)
875. J. Bindley and J. Hinks, Birmingham—Imp. in rotatory steam-engines and pumps, a portion of which imp. may also be applied to the bearings of shafts or axles, and other rotating bodies.
877. M. Wheeldon, 174, Liverpool-road, Burslem, Staffordshire—An imp in looking glasses and mirrors.
879. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the treatment of mineral phosphates of lime. (A com.)
881. W. Hooper, Mitcham, Surrey—Imp. in insulating and protecting telegraphic conductors.
883. W. Henderson, Alderley Edge, Chester—Imp. in treating certain ores and in obtaining products therefrom.
885. E. R. Handcock, 23, Norfolk-street, Strand—Imp. in steam and other motive power engines.

Dated 9th April, 1859.

887. E. J. Hughes, Manchester—Imp. in the manufacture of woven fabrics. (A com.)
889. J. H. Young, 66, Great College-street, Camden-town—Imp. in setting-up (composing) and distributing types.
891. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production of the ferrocyanide and cyanide of potassium. (A com.)
893. J. Martin, 4, Buckingham-street, Islington—Imp. in the materials used in the manufacture of bonnet fronts and ruches.
895. W. E. Newton, 66, Chancery-lane—Imp. in steam engines and boilers. (A com.)
897. R. Brown, 5, St. Paul's Churchyard—Imp. in stoves and apparatus for warming and ventilating apartments and buildings.

Dated 11th April, 1859.

899. R. Wappenstein, Manchester—Imp. in cop tubes, and in machinery or apparatus for placing the same on the spindles used for spinning and doubling fibrous materials.
901. J. Anderson, Liverpool—Imp. in the construction of the furnaces of bakers' ovens, for the purpose of consuming smoke, which imps. are also applicable to the consumption of smoke in other furnaces.
903. L. Wimmer, Vienna, Austria—An improved preparation for killing beetles.
905. W. Rowan, Belfast—Imp. in spinning flax, hemp, and other fibrous materials.
907. W. S. Clark, Aberdare, Glamorganshire—Improved means of loading ships or vessels with coal, and of separating or removing small coal therefrom.
909. J. Marland, Southport, Lancashire—An imp. in the manufacture of cop tubes.

Dated 12th April, 1859.

913. G. J. Johnston, Ashley, Cambridgeshire—Imp. in drills for drilling of corn, seeds, and manure.
915. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of iron. (A com.)
917. C. Burrell, Thetford, Norfolk—Imp. in apparatus for screening corn and seeds.
919. J. Crossdale, Rotherfield-street lower, Islington—Certain imp. in boots and shoes.
921. R. A. Brooman, 166, Fleet-street—Imp. in the preparation of red dyes. (A com.)

Dated 13th April, 1859.

923. R. Emery, 6, King-street, St. James's-square—Certain imp. in carriages for common roads.
925. H. Eckborn, 24, Cranbourne-street, Leicester-square—Improving and regulating the production of light in lamps, to which he gives the name of "universal lamp regulator."
927. J. Apperly and W. Clissold, Dudbridge, Gloucestershire—An improved construction of fulling machine.
929. A. R. Johnson, St. John's-wood—An instrument for damping, severing, and affixing postage and other like stamps.
931. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the construction of the axles of railway and other carriages. (A com.)
933. J. Hughes, W. Williams, and G. Leyshon, Brockmoor Works, Brierley-hill, Staffordshire—Imp. in the manufacture of tin and terne plates.

Dated 14th April, 1859.

937. H. C. Coulthard and J. Jordan, Blackburn, Lancashire—Certain imp. in steam-engines.
939. E. Partridge, Stourbridge, Worcestershire—An imp. in the construction of 'pipe' boxes for cart and waggon axles.
941. E. Dowling, Little Queen-street, Holborn—Imp. in parts of scales or weighing machines and in balance weights used for those articles, which are also applicable for other purposes.
943. A. McDougall, Manchester—Imp. in coating metallic surfaces.
945. S. Barnwell, Coventry, and A. Rollason, Birmingham—Imp. in the manufacture of umbrellas, parasols, hats or hat covers, caps, capes, coats, mantles, dresses, gloves, and other similar articles.

Dated 15th April, 1859.

947. W. A. Gilbee, 4, South-street, Finsbury—Imp. in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed.
949. G. Ashcroft, Cardiff—Imp. in working presses and other hydraulic machines.
951. H. A. Silver, Cornhill—Imp. in insulating wire for electric telegraphs.

Dated 16th April, 1859.

953. T. White, Edgbaston, near Birmingham—An imp. or imps. in frames or stands for holding liquor bottles, pickle jars, cruets, and castors, and for holding bottles and vessels generally.
955. L. Collier, Rochdale—An improved feeding apparatus, applicable to grain, loaf sugar, drugs, or other similar materials.
957. E. Newton, 66, Chancery-lane—Imp. in the manufacture of alumina. (A com.)
959. A. Courage, Bagillt, Flint—An improved method of obtaining the metallic particles contained in fumes or vapours from lead and other smelting work.
961. J. Sidebottom, Broadbottom, near Mottram, Chester—Imp. in the construction of tubes and partial tubes, and in machinery or apparatus for placing them on the spindles of machines used in spinning, doubling, winding, and warping; also imps. in machinery for making such tubes and partial tubes.
963. N. Kenward, Sutton, Surrey—Imp. in machinery for obtaining motive power by fluids.
965. W. Walker, Liverpool—Imp. in rocket guns. (A com.)

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

997. L. P. Porter, New York—Imp. in knitting machinery. (A com.)—20th April, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, April* 29, 1859.]

April 29th.

2418. J. Wright.
2419. G. Zanni.
2420. R. W. Chandler and T. Oliver.
2422. L. J. Lewis.
2423. J. Morris.
2428. F. Wrigley.
2314. H. H. Henson and W. F. Henson.
2432. J. Dobson and D. Pearce.
2433. J. Cariss.
2491. J. Richmond, J. Quick, and A. Fraser.
2679. C. Parker.
2711. W. E. Newton.
2751. L. Bissell.
2871. A. V. Newton.
235. W. R. Alexander.
237. O. Hussey.
383. J. Evans.
581. J. Fraser.

[*From Gazette, May 3rd*, 1859.]

May 3rd.

2453. V. Blumberg.
2458. J. Fowler, jun., R. Burton, and D. Greig.
2467. R. A. Brooman.
2471. T. Till.
2472. T. B. Smith.
2477. L. Schwartzkorf and F. C. Philippson.
2485. J. Cliff.
2489. J. Jackson, A. Fisher, and J. H. Harney.
2495. J. Wardill.
2510. W. Clark.
2544. J. Benyon and J. W. B. Bowden.
2570. J. H. Johnson.
2595. W. Clark.
2626. J. H. Johnson.
2738. E. Jones.
522. W. Burgess.
530. J. H. Johnson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, April* 29, 1859.]

April 16th.

928. U. Scott.

April 26th.

1091. L. L. Jardin and J. Blamond.

April 27th.

1009. T. Restell.
1020. J. H. Johnson.
1027. W. E. Newton.
1059. A. Chadburn.
1087. A. C. L. Devaux.
1211. C. de Jongh.

[*From Gazette, May 3rd*, 1859.]

April 28th.

1029. H. Mapple.

April 30th.

1028. N. Defries and G. H. Bachhoffner.
1033. R. A. Brooman.
1042. W. Naylor.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4165	April 14.	Photographic Portable Dark Operating Tent	William White Rouch	180, Strand, W.C.
4166	,, 20.	Roof Lamp for Railway and other Carriages	Howard Ashton Holden	Birmingham.
4167	,, 21.	Washing Machine and Churn	George Henry Ellis	Malton, Yorkshire.
4168	,, 27.	Parts of an Apparatus to be used in Sowing Mangold-Wurzel or Turnips	John Young	Vulcan Foundry, Ayr.

Journal of the Society of Arts.

FRIDAY, MAY 13, 1859.

EXAMINATIONS, 1859.

The total number of Local Boards of Examiners formed throughout England, Scotland, and Ireland is 76; of these 54 have this year returned candidates for the Final Examination, as against 40 last year.

The number of candidates returned as having passed the previous Examination is 546, and of these 526 (as against 337 last year) have signified their intention to attend the Final Examination which will be held next week, on the evenings of the 17th, 18th, 19th, and 20th instant, under the superintendence of the various Local Boards.

The letters of instruction to the Local Boards (Form No. 5. See Appendix to the Examination Programme) have been issued, and the Examination Papers will be duly forwarded.

A Numbered Card and a Copy of the Timetable have been forwarded by post to each candidate.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th ult., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

CONVERSAZIONI.

The first Conversazione of the present Session was held on Saturday Evening last, at the Society's House. The whole of the rooms were thrown open, and in the Great Room was arranged a series of busts and statuettes of the Crimean and Indian heroes, by Mr. Matthew Noble and Mr. G. G. Adams; also a modelled design for a monument to the memory of the Duke of Wellington, by Mr. John Bell. On the tables were displayed a large variety of models and specimens, including Mr. Henry Maudslay's glass turned in the lathe, glass screws, and geometric figures turned upon glass. Mr. Warren De la Rue's stereoscopic views of the moon, and those by Mr. Fry, were exhibited, as well as that gentleman's stereoscopic views of waves of the sea. Mr. Ladd attended and exhibited some microscopic specimens of photography, by means of some of his powerful instruments. The series of chromo-lithographs recently prepared for the Arundel Society, being copies of some of the Florentine Frescoes, as well as some of their more recent fictile ivories were lent for the occasion. The improved oxy-hydrogen light of Mr. James Copcutt was exhibited by the Hon. Major Fitzmaurice, as well as his improved gas, which was shown in action by means of a portable lamp. Messrs. Wilson Newton and Co., and Mr. Thomas attended and showed their improved stitching machines; and Mr. Clarkson explained the peculiarities of his combination of cork and canvas, and illustrated its capabilities for constructing articles of dress, as also its strength, lightness, and suitability for life-boats and life-buoys.

Mr. Bestall explained his instrument for showing colour by polarised light; and Mr. Bennett Woodcroft contributed some singularly beautiful specimens of tempered steel from the Museum of the Commissioners of Patents.

In the committee and adjoining rooms were exhibited specimens of painting on mirrors, by Signor Agneni; the new water gas light by M. Gillard, as also Mr. Clibran's arrangements for lighting and regulating street gas lamps. Messrs. Murray and Heath exhibited their new electro-magnetic engine, and Mr. Henry Johnson's deep-sea pressure gauge and volutor were described and worked. The Preserved Fresh Meat Company sent some specimens of meat cured by their process in February last. Messrs. Powell exhibited specimens of photography applied in the decoration of glass vases. Professor Tennant forwarded the first gold nugget imported from Australia into this country in 1851, and a model of the largest specimen received up to the close of the year 1858. Many other interesting specimens and models were shown, including the type-composing machine by Mr. Hattersley, a description of which is given in this day's *Journal.* See page 452.

The collection of the patented inventions of the last twelve months, arranged in the lower rooms, was thrown open, and many of the patentees attended and explained their models in action.

The collection was retained for the inspection of members and their friends during the whole of Monday.

The thanks of the Council are specially due to those gentlemen who so kindly lent their specimens on this occasion.

The Second Conversazione of this Session will be held on Saturday evening, the 28th inst., at the South Kensington Museum, the card for which will admit the member and two ladies, or one gentleman. These cards have been issued.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following letter has been received from the Trustees of the National Gallery, in reply to that addressed to them by the Council of this Society. See present volume of the *Journal*, p. 333.

National Gallery, 3rd May, 1859.

Sir,—I have to state that your letter, dated the 14th last, was laid before this Board yesterday, and that as the arrangements for the National Gallery at South Kensington are still incomplete, the consideration of the proposition of the Council of the Society of Arts, the subject of that communication, was postponed to a future meeting of the Board.

I am, Sir,
Your obedient servant.
R. N. WORNUM,
Keeper & Secretary.

P. Le Neve Foster, Esq., Secretary,
Society of Arts, &c.

TWENTY-SECOND ORDINARY MEETING.

Wednesday, May 11, 1859.

The Twenty-Second Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 11th inst., Sir John Harington, Bart., in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Bell, J. Lowthian
Eddison, Richard
Elkington, Frederick
Fawne, John Anderson
Staufen, Werner
Tyer, Edward
Wadsworth, George
Williams, William

The following Institution has been taken into Union since the last announcement:—

Lichfield, Free Library and Museum.

The Paper read was—

ON THE RECOGNITION OF MUSIC AMONG THE ARTS.

By Henry F. Chorley.

If this evening ground be entered on which is new to the Society of Arts at its meetings, the explanation of such venture lies in the insertion of Music among subjects of examination taken charge of by the Society, and in the conviction that, within the last five-and-twenty years, the development and cultivation of Music in England have assumed proportions which render further neglect of the art impossible, without an indifference amounting apparently to injustice.

Were this exclusively a musical audience, it would be lost time to bestow an instant on such obvious facts,—as the connexion and sympathy of Music with the arts and sciences—accompanied as they are, with certain phenomena, which are more easy to be noted than explained. Connexion and sympathy have not implied that contemporaneous perfection in Music, Poetry, and Painting, which the writings of the poets may have led us to expect. When the tragedy, the sculpture, the architecture of the Greeks was in the prime of their glorious refinement and completeness,—that which the Greeks enjoyed as music, seems so far as we can apprehend it, to have been little short of barbarous in its rudeness and cacophony. Now with regard to what is true and great in art, tastes do not change, though forms of society and opinion do. Pindar, and Euripides, and Phidias, have not been cast down from their thrones by any rumour of fashion, still less by any successors who have out-done them. If there were any musicians who rose to the height as these great men, the world does not, and now never will know it. To illustrate again. While Horace's odes are immortal (so long at least as tuneful language and lyrical flow shall last), no one has even an idea of the tune of Nero's fiddle: yet the refined poetical days of Rome were thought also to be days of musical refinement. Were we further to examine how in the grand period of Italian painting Music was still young,—immature in some of her features of the greatest and most distinctive beauty—our list of illustrative facts would never come to an end. But one incidental conclusion is to be drawn from matters well known to many of those present, and regarding which the less technically-instructed must accept assurance in place of detail,—which is, that within itself Music, as an art, has conditions, caprices, and incompletenesses, which claim in some measure a separate and peculiar legislation for it. Milton, to resume our illustrations, was a practical musician. Though a Nonconformist, he immortalised in his "Pensoroso" the pealing organ on which he loved to play. Yet, in Milton's day, the instrument was a rude, limited, machine; and organ music, as we understand the word now, had no existence. On the other hand, the unaccompanied vocal music of the Romish church service, and the secular madrigal which spread itself from Italy over Flanders, France, and England, had in Milton's day, passed its meridian of perfection. Palestrina was dead, almost before the author of "Comus" was born.

The list of such peculiarities which make the history of Music complex and interesting, could be lengthened *ad libitum*, but even those which concern our subject—the ebb and flow of the art's popularity—are intractable by reason of their number. One, however, must not be overlooked: the influences which, with changes of opinion and manners, bear on Music,—an art and science yet still incomplete without personal exhibition,—have never been sufficiently weighed. The history of the estimation enjoyed by music in this country, and its real amount of gain and progress during the last century, is eminently instructive. The Puritans had brought part singing, sacred and profane, into disrepute. They had broken the organs in churches as so many engines of priestly insinuation. Again, the persons who ruled the world of fashion, made the beginnings of Italian Opera in this country ridiculous by their exaggerated enthusiasm. There was as yet comparatively little chamber instrumental music in existence anywhere for the home pleasure of thoughtful persons;—and what existed was almost beyond the reach of those who were not opulent, being, for the most part, in manuscript. Politics too had to do with the matter. Our reigning royal family was not so firmly seated on the throne, but that to quarrel with all their pleasures was a charming game of skirmish and annoyance. The regnant German princes brought with them a German musician, and what Englishman would then allow Handel to rule England's destinies? Thus, betwixt religious scruple,—the sarcasm of the Wit, who preferred the sound of his own talk to the singing of St. Cecilia, and political rancour—the art of Music which, moreover, was just then passing through important transitions of its own fell into popular contempt and desuetude. It was too much rated as a pretty toy, good only for the use of the foolish and the effeminate. Englishmen of the middle classes were forbidden to have anything to do with the syren. They might drink as they pleased while the twelve hours of the clock went round, without losing credit for manliness and good citizenship: but woe betide their reputation if they sang ought save table songs, still more if they studied any instrument! Yet, it is no dumb proof of the vitality and charm which belong to this beautiful art, that while it was virtually forbidden to the many, it was creating among the few those imperishable works which do not always abound in times of universal appreciation. It was during this very last century that Purcell, by composing to Dryden's dramas, brought England nearer to having an opera of her own, than she has ever since been. It was then, too, that Handel deliberately sate himself down in this land, and associated his genius with such men of letters and renown as Gay and Congreve, besides illustrating our mighty elder poets; besides perfecting sacred music to a point since totally unapproached. It was at the period when Swift was sneering his worst against the fiddlers and all their fine stuff, that Addison was arranging the legend of "Fair Rosamond" for music. It was at the very time when ladies of quality were deservedly lampooned by Hogarth's pencil for adoring Farinelli, or "fainting at the departure of Senesino," that such enlightened men as Gray and Mason helped the singer by giving him poetry to sing. Nay, later in the century, after Handel, Gay, and Congreve were gone, and when that sort of dead respectability seemed to settle on the amusements of England, which is the least favourable to poetical creation, we shall find among the figures of intellectual London society, one Dr. Burney, inferior as an organist, and not very profound as a writer—from Lynn, in Norfolk,—listened to and accepted as an equal by Johnson; and another, Sir John Hawkins, his rival historian, who had time to produce an elaborate treatise on the art, after having sat on a magistrate's bench all day.

These familiar instances are recalled merely in proof that Music, in being lately so largely cultivated, has not been so much discovered as reinstated in her old place among men of English science and art—a place never wholly lost. But indeed the links which bind her to both worlds are indissoluble. To tell of the love which musicians have always had for painting, and painters for music; to remind you of Gainsborough bartering one of his best landscapes for Abel's *Viol-di-gamba;* of Handel haunting picture auctions as his pastime, and myriad instances of the kind, would be so much leisure wasted in mere anecdote. But it may be submitted that some of the claims of Music on the good construction of men of science are too much forgotten.—All its deep and mysterious connection with the science of acoustics is not here to be touched, because this would lead us to the question of materials, not of results. Optics and chemistry have both to do with painting; inasmuch as harmonies of light and shade, and qualities of pigments are involved in every line drawn, in every tint tried; but one who spoke on pictures in a mixed assembly, might be forgiven for not touching on subjects so delicate and inexhaustible. But the amount of calculation involved in every musical result has been undervalued. Creation in music is not to be accomplished without study of periodicity, number, and accumulation by rule, such as must be carried out in higher forms by calculators and mathematicians. The frequency of a taste for calculation requiring close intellectual exercise among great musicians is worth noticing. Even Mozart, that lively South German, spoiled by a childhood of prodigious exhibition,—dissipated, facile, for ever floundering through a sea of money troubles,—found frequent amusement in working out difficult sums in arithmetic. Herschell's astronomical discoveries did not begin till after he had made a reputation as an organ player. The champion of chess, in the last century, whose book was a text-book of that tremendous game, and who, after he became blind, could play three games at once—was Philidor, one of the most popular composers for the comic opera at Paris. Not a few of the most accomplished musicians now living could be named who are formidable chess-players.

Then there can be no musician competent to exercise the graver employments of the art, in whom the powers of perception have not been scientifically cultivated to a very high pitch. Consider a page of score, which a pianoforte player may be called on to represent by his fingers on the pianoforte at sight. This page of score contains a phrase of music not so long as an Alexandrine line of verse; but to make up this one line of music there are twenty incomplete lines written one underneath the other, and these written with half-a-dozen variations of alphabet, with half-a-dozen divers readings of A's and B's. A skilled musician should be able to decipher and combine these at a glance; to select the points of importance, to compromise with the fillings-up, and to give his listeners an instant sketch of what is on the page. The conductor of an orchestra has to reproduce this feat with modifications every night that he conducts. He has not merely to indicate his intentions to the players on the twenty instruments that fill the page, but also to do this in subservience (supposing the case an opera) to many principal characters on the stage, who must be watched and waited on,—often with the addition of a chorus moving hither and thither, grouped or scattered. To bring such an attempt to a good issue, under circumstances where failure and interruption may occur at any moment, requires certain faculties and certain talents, such as entirely remove those who can master the feat from beyond the pale of neglect, as so many frivolous toy-makers.

Now, if such be the place that Music has always held in England,—if it be essentially linked to other arts and sciences, yet, singularly liable to conditions of its own from social changes;—if such be its requirements, is it fair that the recognition of Music in England should be merely one of barren sufferance, or else of individual enthusiasm?—Let us see how the practice of it has returned, grown, rooted itself amongst, and held fast the English people, since this century came in. Yet to indicate this within the compass of a quarter of an hour, is something like the attempt at producing a panorama in a pill-box.

The discouragement given to every imaginative and graceful art in England by Puritanism, has been mentioned. But Puritanism, or Protest, or Dissent, or Asceticism, have, and always will have, among themselves, shades and differences. So soon as ever the Dissenters began to get rich, they began to want outlet for imagination, luxury, amusement—to differ among themselves in defence of their own eyes, ears, and preferences in taste. Shortly after this century began, began also the movement among the Wesleyan Methodists, which led to something like a schism among them on the question, whether organs should not, or should be in their chapels. Earlier, among the manufacturing families of our provincial towns, totally beyond the sphere of fashionable influence, might also have been discerned steps taken in the direction of artistic enjoyment; showing that England would not be thwarted in its love for what is beautiful. One of the first persons in Europe, out of Austria, to admire and watch eagerly for the originalities of Beethoven, the great German composer, was a Leicester stocking-weaver, Mr. Gardiner. His efforts in the cause of music were anything rather than unimpeachable in point of taste, but their existence is valuable both as an evidence and a prophecy.

Here it is essential to remind you that every nation has its own strongly marked predilections and superiorities in the art. In England, these direct themselves towards vocal music. Why we should be less adroit as instrumentalists than as singers, might be explained in the small amount of our leisure disposable for the purposes of recreation and in our reluctance to accept that severe and patient discipline without which there is no training of the fingers. Our nationality, however, found a singular amount of nourishment and response in the residence among us of a man like Handel, who accepted England as his home; who enjoyed the humour of its people; who had entered more or less into the genius of its great authors; and who had been sustained in his fight with fortune by that direct royal patronage which, in art as in authorship, was, in Handel's day, the condition on which art and authorship worked everywhere. But Handel's greatness was in nothing greater than in the fact that, after he fell somewhat out of fashion among the court public, he got hold of the great English people. Long ago, among the wolds of Yorkshire and the small unsightly towns of Lancashire, Handel had a public and executants. While he was next to unknown in Germany, totally so in Italy, and in France a myth, there was hardly a country chapel with its small organ in the districts alluded to that did not give its "Messiah," its "Samson," its "Saul," its "Judas," its "Acis and Galatea." Owing to this perpetual repetition and tradition kept alive among people happily endowed by nature, the Lancashire Chorus Singers became of consequence in London, and were called up to sing at London's most aristocratic concerts, even when London was, by coach, some thirty hours distant from Lancashire.

Contemporaneously with their singing, many foreign instrumentalists settled in England during the insecurities of a troubled time. Out of this cluster of foreign artists, joined by some of our own, in a soil as ready to receive them as it had been to receive Handel, Haydn, Mozart, grew the Philharmonic Society of London, a corporation in advance of its time; the body (you may be reminded) to whom Beethoven, when he conceived himself dying in Austria of penury, appealed for English friendly support, which was instinctively granted him.

By this union of an instrumental society in London with this honest provincial amateurship, was mainly kept alive the provincial Music Meeting in England (in mentioning which no historian can pass over the commanding position taken by the Birmingham Festival), and the local concert, at which the new player or new singer, the Paganini or Catalani of the minute appeared. This state of things lasted till the year 1830, or thereabouts; till the time when railroads began to make their influence felt in this country, and when our increasing intercourse with the continent had somewhat slackened the rigour with which the Englishman who adopted music as a pursuit was regarded. In the year 1834, the spell to which we have never ceased to respond, was tried again. In that year was held the Handel Festival in Westminster Abbey; but even then, such a gathering could not be accomplished, without every corner of England yielding its *quota* of professional singers. A London amateur or two, however, aggrieved that their services were declined in the chorus, started the idea of doing something musical in opposition, and got up their own festival in Exeter Hall later in the same year. There a small body of singers, mainly consisting of the tradesmen in the neighbourhood, had already assembled for practice, and out of these festivals and the movement, the Sacred Harmonic Society took its form; which form has of late years perfected itself, till the Society has become the leading body of its kind in Europe. During six months of the year the variety and scale of its grand performances of works of serious music, the number and quality of its audiences, form a feature in the story of musical execution without parallel in any other capital. And it may be predicated that the coming Handel Commemoration at Sydenham organised by it, and the nucleus of which consists of some fifteen hundred trained and selected resident amateurs of London, will surpass in majesty any former celebration of the kind.

The next start in date of time and of importance was that made some twenty years ago, by the the adaptation of a foreign method of training singers in large masses, giving them, at the same time, a rudimental musical education. The instantaneous passion with which this was adopted by persons of all classes, ages, and professions, though it touched the whimsical, and was certain to be followed by a reaction, was a sign how eager was the welcome for such an enlargement of our social pleasures—and with this object, the teaching of vocal part music in classes was adroitly seized hold of by Government, then anxious to popularize a scheme of National Education. It is not our purpose to examine whether all that was done was wisely done; to recall attacks, controversies, rivalries, to detail how immoderate expectation was followed by a temporary collapse of interest as little warrantable. Neither must it be forgotten that other amiable and indefatigable persons had opened the question of class teaching in vocal music before Mr. Hullah brought his method forward. But these attempts had excited only local notice, and it is impossible to overlook the fact, that the recognition of music, as entering into the scheme of every Englishman's education,—that its readmission into our high schools and colleges, and its immense growth among our working classes, whether they are clustered at some new railway town, as at Crewe, or Wolverton, or Swindon, or are congregated in the employ of the aristocrats of manufacture, that the invention of cheap publication for Music, even now in its infancy—date from the proceedings of Mr. Hullah, and the sudden patronage which at the outset attended them.

To number, now, the societies, great and small, the myriads who read at sight what their predecessors only painfully acquired by heart,—the musical resources of London which, in 1830, depended on "the Lancashire Chorus Singers,"—would not be easy. The singers who could be convened in London, and combined from every class of society, are to be counted by thousands; and, considering our great distances, our discrepancy of hours, the engrossing nature of our occupations, the amount of good work, good will, and good result to be got from them, to use a worn phrase, amounts to a great fact.

Nor is it in London only that this animation has made itself felt. It is superfluous to designate such buildings as the Halls of Birmingham, Liverpool, Bradford, Leeds, Manchester, in each of which has been built its organ of a scale formerly totally unknown in England; in each of which is assembled a powerful chorus; each of which can be, and is, filled to overflowing when good music is performed. Even from a remote town, comparatively so little opulent as Aberdeen, come tidings of a new hall, a new organ, and five hundred chorus singers, to be tried and sifted, and selected from, with a view to its inauguration in the autumn of this year.

It has been already pointed out, that England's taste for music shows its strong bearings and preferences. To appreciate that which is instrumental in music, wordless, and prolonged, implies a smaller and more choice public than such crowds as frequent oratorio or opera. But in this branch of the art, too, enormous has been the increase of intelligence in England. Thirty years ago a Quartett or a Sonata was charily produced, as a bit of "*caviare* to the million," at the one instrumental concert which London then possessed:—that of the Philharmonic Society. Now the opportunities for hearing such music and for enjoying it are increased thirtyfold. The weekly Monday music in the St. James's Hall—and the catalogue of the works performed in the Free Trade Hall at Manchester, during two consecutive winter seasons, may be appealed to in proof of the progress of English appreciation in this department of the art also.

The minor and collateral facts which could be grouped from every corner of England, from every world of society, are not so perplexing to the speaker by their number as they would be tedious to the hearer. There is now an organ in Rugby School. The Liverpool Lending Library, purposely organised for the recreation of the hard-worked clerks and shopmen of that town, reports it expedient to purvey musical publications as part of the library of books to be lent. At the last great Birmingham Festival, the Town Hall was girdled round with a crowd of people, on the causeways and in the kennels—poorly-clad working people, thousands in number, who stood patiently for three hours to catch from without the sounds from within, and some of whom followed music from cheap printed music books. There was a gratuitous performance of the "Messiah" given shortly after this year came in by the Manchester gentlemen to their workmen. The testimony of some twenty of the performers of all classes engaged there assures us that the delight, decorum, and discrimination of the public, made the performance a delight for those to whom it has been entrusted.

This remarkable development of Music has followed a law of society with us. We can understand why bodies of persons congregated by every manufacture should take to part-singing readily, theirs being a life of daily discipline. But, on the other hand, our soldiers, also congregated under daily discipline, do not sing:—a thing strange to any one familiar with the sounds which issue from every German barrack. Observe moreover, that in England no vocal music of masses for men alone, without female admixture, has ever prospered. The Liedertafeln Societies of Germany are club pleasures arranged for the men when they have escaped from the housekeeping companionship of their domestic life. Our club-frequenters go to read the papers rather than to sing; neither do the best of them conceive female society a restraint in their pleasures—it may be because of the higher intellectual training of the English woman of the middle classes.—In all cases where amateur women participate in German public musical recreation there is something of state and festival. Here it comes as a matter of course.

Music again has a claim on recognition in the calls which are perpetually made on those practising it by Beneficence, Science, and Art, so often as any of their institutions stand in need of recommendations to attract the public. But if more generous arguments than those belonging to debtor and creditor cannot be introduced and weighed here, it would be fruitless and unbecoming to urge that plea.

Let us now meet the inquiry. What sort of recognition—what form of assistance do you desire? Let us consider the natural objection. What need to recognise that which testimony and memorial profess to be in such a flourishing estate as the state of music in England? Now, without pretending to lay down any law in the desire to excite discussion, certain considerations may be submitted in regard to an art which (to recapitulate) has caprices, conditions, and nationalities of its own—which bears intrinsic relationship to science—and an historical affinity and affection to other arts.

Let us see in England what some of the leading wants are:—

There are, first, not sufficient professional musicians in England to supply the present public demand; and this gives occasion to the pretensions of mediocrities, who, knowing themselves certain of employment, work little, demand a consideration disproportioned to their value, and tend to make of Music a pleasure more expensive than accessible. No reference can be hereby made to persons of genius. For their remuneration no standard can be provided. There can be no tariff by which the novels of a Scott or a Dickens can be valued; nor the representative powers of a Rachel, a Lind, or a Paganini, rewarded. But there is great overpayment in one branch of the art among the mediocrities—and this grinds heavily on persons no less worthy in other branches. Because of the paucity of solo singers they are rewarded out of proportion to their merits—because of such disproportion the instrumental musician is insufficiently requited. Now, to be a good orchestral player, demands as entire a life's devotion as to be a good vocalist. The fingers are as hard to train; the breath in the clarionet or bassoon is as difficult to regulate, as the most rebellious voice. There must be for both intelligence and science. But the emolument of a first-rate viola, oboe, or bassoon, as compared with that of a second-rate singer, is as one to ten—if not as one to twenty—hardly sufficing, after a much longer career of toil, to ensure the labourer a pittance for his old age. This inequality must be righted, in some small degree, were the standard of professional merit raised higher; and by the very measures adopted to raise this standard, something might fittingly be done, in recognition of the talent of a valuable yet ill-paid class of public servants.

In their case, public intervention might usefully replace that old direct patronage provided, and which to this day abroad, provides decoration, pension, and maintenance, for those concerned in the representative arts. Recollect, however, that for the musician no such claim can be put forward as for the man of letters. Though the studies of player or of singer may have engrossed a whole life, they are measured, with a different standard, by public opinion. For him there can be no such indirect requital, as for his brother artist in poetry, or in fiction. Farinelli, the singer, it is true, was made a Prime Minister in Spain, and the late Emperor of Russia gave Rubini a regiment; but we should not dream of offering Mr. Sims Reeves a portfolio, or a treasury clerkship—or of representing that Miss Dolby should fill a place near Her Majesty's person, as did the authoress of "Evelina" in the reign of a former Queen of England.

Yet seeing that music is a science as well as an art, some compensating recognition and aid might be afforded in the matter of education—such as hardly can be given to drama, poetry, or romance. Out of no college exercises could come a "Manfred," a "Bride of Lammermoor," or a *Mistress Gamp*. In no female academy could a Miss Edgeworth, or a Miss Austen, be trained how to weave their admirable tissues of art from the materials of everyday life. The musician even depends more on teaching and training than the painter, because his is a more exact science. Rules and processes are essential to his excellence, whether he be a composer or an executant, which no mother instinct, no imitative quickness can supersede.

This education question is beset with difficulties on every side; in no case more thickly beset than in that of Music. Some years ago, when the Council of Education availed itself of the assistance of music to popularize its plans, an attempt was made to gain a subsidy for the methods which had excited so much attention and bore such immediate fruit. The Council, however willing to call in the art as an aid, declined protecting it in any way; and considering the difficulties of the question at that time, any vote which might have been then gained, might have caused so much cavil, might have been so wrested from its true purpose, as to have failed in its object. It may not prove practicable to help on music, when it is employed in its diluted form, as an accomplishment thrown in to lighten more severe and scholastic studies; but a central college, affording the best and cheapest education to professors and artists of the highest class, might prove an object of care, more manageable, perhaps, or more beneficial. We cherish a tree at its roots, more efficiently than by watering its single leaves or by training its smaller branches.

It is true that we have what is called a Royal Academy of Music in London: an institution which it would be pleasanter to pass by than to enter. By entering it some pain must be given to worthy persons, but attention must be called to the capricious basis on which that structure stands, and to the peculiarities of its organisation. These are of such a nature, that during the last twenty years not one single artist, capable of doing England, or the Academy, or music, credit before the public, has issued thence—not a single singer capable of saying and singing the songs of Handel, or able to cope with foreigners in foreign singing—not a single instrumental player of any renown—not a solitary composition which has lived beyond the hour when it was transcribed from the exercise book. During twenty years past London has contained materials for such a central college as can exist in no other European capital; the illogical consequence has been, that our students of both sexes have been driven abroad, partly because of the superior cheapness of instruction—partly because of its superior quality.

It has been asserted that London is richer in material than any other capital. The difficulties of getting a complete foreign musical education are manifold for an English student, who must needs acquaint himself with all styles and countries of music. The conservatories of Italy, Germany, and France, had and have each their special excellences. Italy, pre-eminent for the use and training of the voice;—Germany, for instrumental proficiency and general theory;—France, for readiness and brilliancy, especially as connected with stage declamation. Each of these schools has its preferences as well as its prejudices. The Italians, as a class, regard German music with a mysterious and impatient antipathy. The Germans have a distaste for every thing in music that is Italian, as something slight and sensual, and when they try to enter its domain they do so heavily and awkwardly. The French stamp a French seal on both German and Italian music ere they will allow either to pass the barriers of Paris. One language, one style may be acquired in each country; but did the English student successively study in all the three schools, he would have to add, to complete—and to prepare himself for English tastes, habits, and occupations on his return.

In pursuance of this assertion a step further, your attention must be drawn to the influences of foreign education on the character and manners of the musician. Perhaps there is no class of exhibiting artists who, in these respects, stand in such need of wise and thoughtful training as they—exposed, as they are, perpetually, on the one side, to public flattery, on the other, to private association with persons less educated if not less scrupulous in morals than themselves. The good side of life and of manners in foreign countries is less likely to strike young and inexperienced visitors endowed with the artist's temperament than the slackened sense of duty and obligation—than the facility of certain pleasures and indulgences, which neither magic nor money can produce for them on their return home. Very few have returned without having something to regret, and much still to learn, yet more to unlearn. And since women play a much more indispensable part in Music than in other arts, it need not be suggested how, in this particular branch of education, the separation of families, the breaking of home-ties, the adoption of foreign manners and habits, useless at home, are so many things to be deprecated by all who do not separate art from manners and morals—from all that is comprehended in the word civilisation.

A more practical fact remains to be advanced. While our English respect for music, and while, in consequence, our cultivation of music has increased, the great foreign schools have been dwindling in authority, because the greatest professors have been gradually diminishing. The fact is, that some of the best have been led to root themselves in England. That many of these have no place in our Royal Academy is to be accounted for by the dearness of life here, and the high fees to be obtained by private tuition. Such professors, as matters stand, cannot be expected to devote themselves to professional pupils on fees so disproportioned to those which they receive from fortuitous sources. Hence, it must be told, has arisen, in our unbeneficed Royal Academy, that system of deputies and subordinates in which the raw and crude student has been too often allowed to take charge of the education of the pupil only a stage more raw and crude than himself, who has entered the school in good faith and hope of a first-class education, yet whose education costs him more than it would have done at Leipsic, or Paris, or Milan, or Brussels. Is it Utopian to fancy that, by a certain sum devoted to endowments, a superior and less variable quality of instruction might be obtained? thereby recognising the merit of the best professors whom we may possess by birth, or may entertain by position; thereby making it possible for English parents to educate English children at home, on accessible terms, in all the great schools of music, in all the great branches of art, with an eye expressly to English wants and capacities—and without that utter disruption of family ties and sympathies, which, in England, can never take place without some chance of failure and unhappiness among those who, however glad to go, are yet compelled to return. Is it Utopian to fancy that with some such scheme, there might be combined some such plan of travelling scholarships, as forms part of the statutes of the Conservatory of Paris? In reward maintenance for a while of such pupils as had most notably distinguished themselves. Such might, by foreign experience and enlargement of sympathy, be led to enrich, not denationalize themselves, so as to do honour to Music's country, which is, after all, the whole civilised world.

It seems not wholly extravagant to conceive that London, Birmingham, some central town in Yorkshire, and Manchester and Liverpool conjointly, might enjoy this advantage in recognition of the remarkable advance shown in the cultivation of music, and of the services which these districts render to the great cause of art. It seems not grasping at a vision to submit that such a scheme might be cautiously tried, and gradually extended; and what is more, though not self-supporting, be turned to account in raising the standard of execution, and enlarging the resources brought to bear upon public representations.

The pupils of the Music School at Paris can, to a certain degree, be claimed by the government theatres of that city; and hence it arises, that though every year does not bring its complement of artists of genius, the average service of such theatres in Paris is better, and attainable on easier terms, than in many far cheaper capitals. That some theatre, relieved of some among the heavy incumbrances which weigh on such undertakings, and on no overgrown scale of pretension or cost, might be connected with such a central college as has been adverted to, is perhaps not impossible. Then, supposing some such provision for education tried, is it Utopian, further, to fancy that Government might recognise Music by calling it in, as it does painting, to take its commemorative part in the celebration of national events? Why should not such court patronage, as in the last century called from Handel the famous Dettingen Te Deum on the occasion of a victory, be replaced by a National Commission for Music to put forth its powers when a great victory is won, or when the nation buries its great hero, or when a great peace is concluded? If our painters and sculptors are summoned to decorate our palace of legislature, to raise trophies and effigies in record of achievements, is it in justice that a sister art should be shut out, or admitted by hap-hazard, as it were, so as to leave no chance for the hymn of the hour becoming a poem for all time? Considering what we have seen of its acceptance among all classes, of its recent growth in this country with a rapidity almost unrivalled, the question is worth being considered by all generous persons. To give the world anything analogous to "See the Conquering hero comes," or "Rule Britannia," or a setting which should set out such a lyric as "Ye Mariners of England," is an attempt to be no more neglected than that which tries to write England's great deeds on the walls of her council chamber, or to raise a fitting tomb to England's great warrior, when at last he is taken home.

There is yet another form of recognising Music which may be suggested. What, if some assistance were given to the collection of a musical library? Why might not there be the judicious purchase of manuscripts and scarce works, not irrespective of the curiosity attaching itself to relics? Every month makes such a task more difficult. During the last ten years, some of the most valuable and interesting collections of manuscripts and relics in being have been waiting for purchasers. Among the former, may be named, those gathered by the Abbé Baini, in Rome, which are said to have amounted to the most ample library of antique Italian Church music in being. Among the latter, the original manuscripts of Mozart's imperishable works, and (for England) even more desirable, two series of manuscript copies of Handel's masterpieces, both made under his superintendence, differing one from the other, and both differing from the collection in Her Majesty's library. To all concerning themselves in Handel's music, these different editions in manuscript are as valuable (in their art) as the different folio editions of Shakespeare,—with this superior recommendation, that each was unique. Each collection might have been secured for a moderately trifling sum. Should not some of these things find their way into the National Library, from time to time, in fairness and consideration for the world in which we are living?

Last of all, if any or all of the above suggestions be put aside as premature or prejudiced, this much at least might perhaps be accorded:—such a hearing of evidence and testimony as some years since was granted by Parliament to managers, actors and dramatists, when the question of playhouse monopoly was stirred. Just now, when so many grave questions are before the public, it may seem more than ordinarily frivolous to hint at such a possibility; but this discussion, you will recollect, was appointed ere the present momentous state of public affairs had commenced—and the hint becomes inevitable by way of close to the foregoing speculations. Should such a question be brought to public hearing—in the midst of much that was tiresome, irrelevant, self-interested—information would assuredly be brought together, filling out the meagre outline just offered to you, showing the vast spread of music in this country—its beneficial influences on every class of society—its present wants and disadvantages, as compared with science and art—and possibly confirming, not merely the graciousness, but the justice, too, of some ascertained official assistance to remedy the wants and disadvantages aforesaid.

In any event, by your consenting to receive this paper, a step has been made. While the producer of it feels that he has done imperfect justice to his subject, he may perhaps be allowed to fancy that he has done a labourer's part in preparing the surface, into which some more eloquent and experienced advocate may succeed in introducing the small end of the wedge. The official recognition of music among other fine arts can only be a question of time in England,—because it is one of justice.

DISCUSSION.

The Chairman said it was now his duty to invite discussion on this paper. He hoped some one more eloquent than himself would lay before the meeting, and the public at large, the great importance of music as an art. For his own part, he was one of those enthusiasts who thought that music took a place, second to none of the arts, as an engine of civilisation and social progress. He would be the last person to detract from the merits of what was called the "sister art" of painting, but he did think that in the promotion of social advancement music took almost the first place. The point for discussion that evening appeared to him to be the way in which assistance from government should be applied for and directed. It seemed to him that what was wanted in this country more than anything else, was the means of procuring a good musical education. Musical education abroad was so superior to that in this country, that all the disadvantages of foreign associations had to be encountered, in order to secure really good musical instruction. He felt himself utterly unable to do justice to the subject, but he would express a hope that it would be discussed in a manner which its importance deserved.

Mr. William Hawes remarked, that the present session of the Society had been happily characterised by the introduction of papers upon two of the principal arts, sculpture and music. It was, he believed, the first occasion within his recollection, on which they had departed from the more practical subjects connected with manufactures and commerce. Moreover, the attention of the Council had been given to the consideration of the propriety of introducing into the contemplated Exhibition of 1861, the subjects both of painting and music, neither of which was included in the Great Exhibition of 1851. He sincerely hoped the reading of these papers would be only the prelude to the discussion of similar subjects in future sessions. A subject which the Council had recently had under consideration was the want of a standard pitch for music in this country. He believed there were three distinct grades of pitch now in use in England, viz., the opera pitch, concert pitch, and the pitch of the private musician. If the opera pitch were introduced into private society, he was afraid that they would find very few voices able to perform the music which we were accustomed to hear at the Opera-house. This high pitch strained the voices of the singers and rapidly impaired their powers. It was well known that this subject had occupied attention in the musical circles of Paris, and a commission had been appointed by the French Government to inquire whether one pitch suitable for all purposes could not be universally adopted, the result of which had been that the French had now only one standard pitch for all kinds of music. This was a subject which the Council were proposing to take up, and he hoped it would be fully discussed, and if found practicable, some action taken upon it. He was aware of the difficulty of introducing such a change. Organs and military bands were tuned to a certain pitch, and considerable expense might be incurred in altering the pitch of the existing musical instruments; but it was to be remarked that no great change was ever brought about without considerable cost. He was sure he might say that the Society would be happy to afford every opportunity for a full discussion of the subject, and he hoped this paper and others that might follow it would tend to assist them in their deliberations, and promote the art of music in this country.

Mr. Chorley said the question mentioned by Mr. Hawes was one of so much importance that he might be allowed to say a word upon it. He thought upon this subject of the pitch there had been a great deal of assumption; he much questioned whether the pitch had really been raised, as was asserted. In Mozart's opera of the "Seraglio" there was a bass part down to double D, and if the pitch had been lower then than it was now, a person would have had to sing down into the cellar. Attention having been called to this matter he would suggest to scientific persons whether the metal of old tuning forks might not have changed, so as to affect the vibrations, from one fifty years to another. There was, in his opinion, no certainty that the old tuning forks retained their original pitch after a considerable lapse of time. He had found that when singers grew old, they invariably complained of the pitch.

Mr. J. G. Frith had been much struck with the passage in the paper which stated, "It is true we have a Royal Academy of Music in London, which it is pleasanter to pass by than to enter," thereby implying that no musical genius had ever emanated from that institution. He begged to ask whether such was the case?

The Chairman—The remark in the paper was confined to the last twenty years.

Mr. Frith would inquire whether no eminent composer or executant had been sent from the Royal Academy of Music within the last twenty years.

Mr. Chorley replied in the negative. The last great singer from that institution was Miss Dolby, and the last great musician was Professor Sterndale Bennett, and they both dated from twenty to twenty-five years ago.

Mr. Bowley said that, to his mind, the paper now read marked an important event in music, and in the social condition and well-being of the country. It had been truly said that there was no more powerful engine of social progress than music. To the truth of that assertion he could bear his humble testimony, from the experience of a quarter of a century. If they did no more than call attention to the enormous amount of influence which music exercised upon all classes of the community, they would have done well. He should be sorry if they were led away, by any small questions of detail, from the great object they ought to have in view, which was to demand for music a recognition as one of the best of the arts. He believed there was an amount of readiness on the part of musical professors and amateurs to do good in every way, which was not second to that of the professors of any other art, though he regretted that, from a want of unity amongst them, they had not come forward with sufficient energy to demand for music more full recognition. If they would only work with unity of purpose, what they demanded could not long be refused. He felt a difficulty in setting forth what course should be adopted in order to secure for music that high position to which it was entitled, but if they all put their shoulders to the wheel, some good result must ensue. He felt very grateful to Mr. Chorley for the way in which he had introduced this subject. Whether the assistance should be by Government patronage or subsidy he (Mr. Bowley) was not prepared to say; but he would repeat that the time was come for musicians to demand such a recognition of their art as it was fairly entitled to receive. He could only say that if some proper course of action were pointed out, whereby the objects advocated in the paper could be attained, he would venture to promise the hearty co-operation and support of the musical world generally in promoting those objects.

Mr. C. Wentworth Dilke said he saw a gentleman present whose opinion upon this subject would be very valuable. Mr. Costa had had great experience of the working of Government assistance to public musical institutions in foreign countries. Paris had its Conservatoire of music, and Leipsic and Milan had their national establishments; and he should be glad to hear from Mr. Costa his opinion as to the benefits, if any, that had been derived from Government assistance to those public musical institutions abroad; also as to the manner in which those institutions were carried on.

Mr. Costa expressed his opinion, that if a similar establishment were instituted in this country, Government should engage the best masters that could be procured, without regard to country, and without any prejudice whatever. Students of music certainly ought not be under the necessity of going abroad to complete their musical education.

Mr. John Newton said there seemed to be a want of some suggestion as to the proper way of carrying out the principle advocated by Mr. Chorley in his paper, viz., that music should be publicly recognised as an art, and should receive Government support. When any proposition of that kind was put forth, it was always convenient to have some point to start from. There was now in existence a Royal Academy of Music, and he quite agreed with Mr. Chorley that it was in anything but an efficient state. It had been very truly remarked, that out of that Academy they had not, for the last twenty years, had one executant or composer above mediocrity. He thought there must be something wrong in a system which did not give better results than that, but in his opinion the proper course to be adopted would be to endeavour to put that institution upon a better footing. Several years ago some steps for that purpose were proposed, but, as was frequently the case in the musical world when any united action was attempted, discord ensued, and the result was that the proposal fell to the ground. He thought if some means could be devised by the directors of the Royal Academy of Music, whereby the system of tuition or the plan upon which the education was carried out could be improved, they might then be in a position to go to the Government and ask for a grant to enable them to obtain better and more experienced teachers than they had at present. But until they put their shoulders to the wheel, and endeavoured to improve what they already had, he did not see that they were in a position to ask the Government to help them. He begged to take exception to the word "art" as applied to music. Music, if he rightly understood it, was a science and not an art. It was the interpretation of music that was an art.

Mr. Chorley remarked that it was both a science and an art, and it included personal exhibition. The three things went together, and could not be separated.

Mr. Charles H. Smith said he differed from the writer of the paper as to the state of music among the ancient Greeks, who, he thought, were distinguished for their cultivation of this as well as of the other arts. It had been argued that the instrument they employed, the lyre, judging from the representations of it in their sculpture, was very imperfect. His reply to that would be, that but little idea of what Paganini's violin could produce would be obtained from seeing it represented in sculpture. Moreover, he recollected a circumstance which, to his mind, was an unequivocal proof that the ancient Greeks thought as highly of music as of any other of the arts which they cultivated. There were at the present day in Athens two monuments, in that which was known as the Street of the Tripods, with inscriptions upon them to denote what they were intended for, namely, to contain the tripods given as the highest rewards for excellence in music; and upon those monuments were inscribed, not only the names of the composers, but also of the performers, showing that they held in the highest estimation the one as well as the other. He gathered this fact from Stuart's Antiquities of Athens, in which it was stated that the one monument was erected to Lysicrates, and the other to Thrasyllus, and, as he had already stated, the names of the executants of the music were inscribed, as well as those of the composers. He merely mentioned this circumstance to show that a nation which cultivated sculpture and painting beyond all others, also encouraged the art of music.

The Chairman said that he had hoped to have heard this subject discussed more generally at this meeting, otherwise he should have ventured to have prepared some further remarks to have placed before them. The great object of such a meeting as this was to come to some practical conclusions, which did not appear to have been arrived at as yet. He confessed he had been very much struck with the remark in Mr. Chorley's paper, upon the insufficiency of the self-constituted Royal Academy of Music in this country; and he felt that this resulted in a great measure from what he had always considered to be a great evil in England, namely, that there was so little Government encouragement to undertakings like the Royal Academy of Music set on foot for the promotion of art. A society of this kind got into private hands, and naturally degenerated. This he looked upon as a great evil, and one which required to be corrected by an appeal to the Government. He thought, if it were not too bold a suggestion, that this was the Society to come forward and take the initiative in such a measure. Some suggestion might be made by it to the general body of the

Royal Academy, with a view to the introduction of some improvement in the plan upon which it was conducted. He thought much good might be done by endeavouring to enlarge the circle of the Royal Academy of Music, and to begin upon the foundation which that Academy had already established. He felt bound to say that, in his opinion, the Academy had done great good to the musical science of the country at large, although there might have been some mismanagement which tended to obstruct progress during the last twenty years. He thought the Academy would be the proper medium of communication with the Government. There was one thing which, as their chairman, he must not pass over. He thought this Society, and society at large, were very much indebted to Mr. Chorley for the ability he had displayed and the pains he had taken in the writing of this paper. He had been well known in this country for many years as one of our leading musical critics, and therefore he was just the person to take up this important subject, and that he had done so ably, they had had an opportunity of judging. He would propose that the thanks of the meeting be given to Mr. Chorley for his paper.

Mr. COSTA, in seconding the motion, thought, with all due respect to the Royal Academy of Music, it was no use to mend an old coat. He had a great regard for many persons connected with the Academy, but he thought the best course was to ask the Government to grant a new Academy, without reference to the existing one, to be conducted upon a proper system. In the first instance, any grant of money by the Government should be devoted to obtaining the best professors that could be had, and to the placing of men at the head apart from all prejudice or interest; whilst a proper system of training and discipline should be observed towards the pupils. In England there were the elements for a good Academy of music beyond any other country in the world. The soprano voices in England were magnificent, but the great fault was, that as soon as a certain degree of excellence was attained, the pupil was pronounced perfect, when the education was only half completed. When pupils entered the Royal Academy they should be expected to do their duty, and observe a proper system of training and practice. The Great Napoleon, who established the Conservatoire of Paris, had no undue affection for French professors, but he obtained them from whatever part of Europe they were to be found. He had the best men that could be got, and he placed an Italian, Cherubini, at the head of the academy. They gave the best instruction, and produced the best pupils. If the government granted a sufficient sum to establish a new academy of music, he felt certain that in ten years time they would have an institution the first of its kind in the world. What they had now, he considered was of no use. He thought an amateur ought not to be placed at the head of the Academy.

Mr. REDGRAVE was sorry to hear the discussion had taken the turn of going to Government for assistance in this matter. If they were dissatisfied with the present Academy of music, let the lovers and professors of that art set about establishing a new one. He did not think the objects they aimed at would be gained by any assistance from the Government. They must help themselves, as had been done in the case of other branches of art, and not go crying to the Government for help. He did not think the Council of this Society or the Society itself could support any application to Government for funds to form a musical academy, whilst they had the wealth of London and the provinces to appeal to.

Mr. CHORLEY remarked that the Royal Academy of Painting and the various Schools of Design throughout the country were assisted by the public funds. There were commissions for assisting almost every branch of art with the exception of music, and large sums were annually voted by Parliament for the purchase of works of art for exhibition in the public galleries, as well as for the decoration of the houses of the legislature.

Mr. REDGRAVE believed that a modern picture was never bought by the government.

Mr. CHORLEY added that, for the maintenance of the Royal Academy of Painting, government had made a grant of land of the value of £50,000, besides a vote of parliament every year, which was spent or misspent upon the works of the painter's art, whilst large sums were granted for the decoration of the Houses of Parliament. It was quite right and proper that it should be so, but one art ought not to be neglected whilst the others received encouragement.

Mr. WILLIAM HAWES said that the Government voting money for the ornamentation of the Houses of Parliament, or for the purchase of works of art for exhibition in the public buildings, was a very different thing from granting money for the teaching of a particular art. The two things were very dissimilar.

Mr. CHORLEY remarked, that in the paper he had endeavoured to state distinctly that music had a way of its own, a life of its own, and a form of its own; and therefore what aid they could give to music would not be in the same form as they gave it to other branches of art.

Mr. DILKE did not agree with either party. Large sums were voted every year for educational purposes. They had a Privy Council on Education, and they expended he believed, as much as £800,000 per annum for teaching and training school-masters and school-mistresses, who in their turn became the teachers of others. Whether this was a wise mode of spending money, was a question he was not then prepared to discuss, but he thought, as matters stood, the expenditure might fairly be slightly increased for the purpose of giving instruction in music.

Mr. WINKWORTH observed that any art or science which enlarged the sphere of social enjoyment, such as music and painting, and which could be safely indulged in in connection with the exact sciences, ought to receive both public and private encouragement. There was much latent talent in all classes of life, which, unless developed by some special agency, would be lost to the world.

Mr. SMITH remarked that whilst payments were required from the students at the Royal Academy of Music those of the Royal Academy of Painting paid nothing. He had been a student there for many years, and had never been called upon to pay anything. That might be one reason why they had some claim upon the Government.

The REV. W. H. BUCK agreed with Mr. Costa as to the insufficiency of the Royal Academy as a national institution. They required an academy upon a much larger scale. He would not presume to say in what way it should be conducted, but certainly they ought to have an institution of that kind worthy of England, whose sons and daughters were truly musical. As Mr. Costa had said—"Where could they find such a body of sopranos as was to be met with in England?" They had proof of what could be done in the way of education in music by the experience of the last twenty years. It must be admitted, even by those who differed from Mr. Hullah on some points, that he had done a great deal in the promotion of education in music, but he had only done just sufficient to demonstrate that there was a vast amount of musical talent in this country, and to show that, if it was encouraged as it ought to be, it might be developed to an extent hitherto unprecedented. With regard to musical tuition in schools, in the National Schools music was nominally taught, and the masters and mistresses were expected to pass an examination in it, but he might say that the examination amounted to nothing more than a mere sham. He had seen the printed examination papers which the schoolmasters and schoolmistresses were expected to answer, and from his own knowledge of the science of music, he would say that if they did answer the questions set down they were merely "crammed" for the occasion, and they were not required to reduce whatever musical knowledge they had obtained into practice in their schools. They ought to bring before the Government the importance of national education in music in our schools, not merely for the sake of acquiring musical knowledge, but to enable them to embody national feelings in national singing. He would here remark that, much as he loved Italian music and admired the Italian school, it seemed rather out of place that, in the public performance of the Royal Academy, out of sixteen pieces of music, fourteen were of the Italian school. Surely in an English academy the cultivation of English music was essential. They had for many years lost a grand opportunity of educating the humbler classes in music, by neglecting to prepare the National School children for the annual meeting at St. Paul's Cathedral. It was a scene well worthy of being witnessed; but these National School children, when they grew up, instead of being able to afford aid in their several parishes in the formation of choirs for the places of worship, were utterly ignorant of music, all the pieces performed at that great annual festival, being learnt by ear only. This was owing to the fact that the schoolmasters and mistresses were not imperatively required by the Council on Education to be well up in music when they received their certificates.

Mr. Costa, in saying that, in his opinion, an amateur should not be placed at the head of the Academy, did not wish to imply that the co-operation of influential persons should not be sought—all he meant to say was that the practical department should be presided over by a professor of the most eminent ability.

The Rev. W. H. Buck remarked that there were some institutions founded by public benevolence, to which Government gave a partial assistance. If, for instance, the public subscribed £1,000, Government would contribute a similar sum. But he believed if the enthusiasts in music subscribed £10,000 or £20,000 towards an Academy of Music, it was probable that the Government would give its assistance to the same amount, and in that way the object might be attained.

A vote of thanks was then accorded to Mr. Chorley for his paper.

The Secretary announced that on Wednesday Evening next, the 18th instant, a paper "On the Relative Values of Coal and Coke in Locomotive Engines," by Mr. Benjamin Fothergill, would be read.

HATTERSLEY'S TYPE-COMPOSING MACHINE.

By Henry Bradbury.

Having observed the interest with which Mr. Hattersley's Type-Composing Machine was received at the last soirée of the Society of Arts, and having myself taken some practical interest in the machine, by placing it under a fair business-like trial for two months, I venture to offer the following remarks as to its merits for the benefit of those interested like myself in promoting the substitution, if possible and practicable, of machine for hand labour in the composition of type.

Unlike previous attempts in the construction of machines for this purpose, Mr. Hattersley's is at once simple and compact,—not liable to derangement,—delicate, but strong,—and not requiring that type should be cast with special grooves for the purpose.

The machine consists of a horizontal table, divided into channels of sufficient width to allow the type to slide freely. At one end of these channels is fixed a metal slide, against which, by a vulcanised india-rubber cord, the type is constantly pressed, and held with sufficient force to prevent the last one in each channel from falling through an aperture immediately under it. Under these apertures is fixed, what is termed, the Guide Plate, fitted with downward channels directly under, and corresponding with, the apertures. These channels verge, for the delivery of the type, into one common mouth, which is immediately over the Stick Holder, in the shape of an inclined plane. A modified Composing Stick is adjusted to the Stick Holder, in which it is made to slide longitudinally. The machine is furnished with keys, arranged as near to the present system of compositors' cases as possible. Each key, marked with the letter it represents, is connected with a piston or pusher, situated immediately above the face of the last type in the upper (horizontal) channels. The action of the key is to push the last type through the aperture leading into the Guide Plate, thus liberating the type, when its own gravity causes it to descend through the channels of the Guide Plate into the compositors' stick: as each type drops, it is guided into its place in the stick, which at the same time is pushed longitudinally forward, thereby making a place for the next descending type. A vulcanised india-rubber spring raises each piston into its original position as soon as pressure is taken off the key. Towards the end of each line a bell gives a signal, enabling the operator to judge how many more types he may play into the stick before justifying out, as in the ordinary way, the stick being in a convenient position for such purpose.

The channels of the horizontal table are calculated to hold a quantity of type equal to that contained in two pairs of ordinary cases. To avoid delay, arising from the channels becoming exhausted, the machine is provided with extra supply tables, which can be changed in a few seconds. The average speed as yet attained by the youth, who has been practising upon the machine, may be said to be 4000 letters per hour, from reprint copy, including the justification. To bring it into operation would involve a systematic division of labour, as follows:—

1. Distributing type by hand.
2. Classing type, *i.e.*, arranging letters of the same character in rows.
3. Charging tables with classed type.
4. Composition.

Distributing, classing, and charging the tables, are mere mechanical operations, and can be done as well by youths as by adults. Composition, from MS. or reprint, however, is an operation necessarily of a higher kind, but still capable of being done equally as well by the one as the other labour.

The following statement, comparing the old with the new system, is an example of what might be realised from the employment of machines. The calculation has been made simply with reference to the cost of the number of letters composed—and quite independent of all other extras to which all works more or less are subject, in the shape of making up, &c.

The Extra or Advertisement sheet of the *Times* consists of 8 pages of Ruby type. The composition amounts to 1,029,888 letters, or 205 galleys, at 4s. 3d. each, or £43 12s. Whereas, by the new system the same number of galleys could be composed for £14 14s.; this multiplied daily, or 313 times, would yield a difference of £9,045 14s. in the year.

Again, *Knight's English Cyclopædia* consists of 488 sheets, or 7,804 pages, of Brevier type. The composition amounts to 83,770,000 letters, or 83,770 at 6d., or £2,094 5s. Whereas by the new system the same number of thousands could be composed for £930 13s., yielding a difference of £1,163 12s.

These results have been based upon the employment of six machines, eighteen intelligent youths, at 15s. per week, and one machine superintendent at £2 10s. The youths are qualified for either description of work,—distributing classing, charging, or composition,—and are, therefore able to relieve each other at the composing-machine. It has been ascertained that, to sustain the speed of 4000 letters per hour, a youth, or adult, would require change about every three hours.

The introduction of the one system for the other would be at first attended with a certain amount of inconvenience; the two instances given, however, show that, sooner or later, the type-composing machine will be adopted by necessity, and will have the same relatively proportional advantage over hand-composition as the printing-machine has had over the hand-press.

THE ORIGIN OF THE ELECTRIC TELEGRAPH.

Dr. Hamel, of the Imperial Academy of Sciences at St. Petersburg, who has communicated to that Academy the results of his laborious researches regarding the early history of the Electric Telegraph, shows how the construction of the very first telegraph, worked by a galvanic battery, originated.

On the 6th of August this year, it will be just half-a-century since it was completed at Munich, in Bavaria. It appears that an event in connexion with the war brought on by Austria against France fifty years ago, in 1809, caused the galvanic telegraph to be invented and made.

The Austrian army had on the 9th of April in that year begun to cross the river Inn, and to enter Bavaria. King Maximilian had hardly been informed of this, when he, on the 11th, with his family, in all haste, retired from Munich to the western frontier of his kingdom, to the town of Dillingen.

He took with him Baron von Montgelas, who was at the head of two of the most important branches of administration in Bavaria, the Foreign and Home Departments.

By means of the line of Chappe's optico-mechanical telegraphs, established all the way from the French frontier to Paris, the Emperor Napoleon I. got there the information of the Austrian army having entered Bavaria much sooner than it had been thought possible by the Austrians, namely on the 12th, and he, without delay, departed from Paris for Bavaria on the way to his army. He came so totally unexpected to Dillingen, that he found King Maximilian in bed.

There is no doubt that, to the speedy arrival of the Emperor Napoleon I. in the midst of his army, Bavaria owed its deliverance from the Austrians. Munich had been already, on the 16th of April, occupied by the Austrian General Jellachich, but he was in less than a week after, on the 22nd, obliged to withdraw, and King Maximilian was again able to enter into his capital.

This event, so vitally important for Bavaria and Munich, must there have directed a special attention to the utility of telegraphs.

Baron Montgelas had been witness of the surprise caused by the French Emperor's unexpected arrival at Dillingen. Under his extensive administration was also the Munich Academy of Sciences. Dr. Samuel Thomas von Soemmerring, the well known anatomist and physiologist, who had been since 1805 a member of that Academy, was from time to time invited to come to dine with the minister Montgelas at Bogenhausen, near Munich, where he lived. This was the case on the 5th of July, 1809, when the minister expressed to him the wish to get from the Academy of Sciences proposals for telegraphs, having, it is to be supposed, in view no other but improved optical or mechanical telegraphs.

Soemmerring, who had, like Humboldt, very early paid attention to galvanism, in hopes of being able to make its study useful to clear up some of the most mysterious portions of physiology, and who also had now closely followed and noted the brilliant chemical discoveries made by Davy with the galvanic battery in the laboratory of the Royal Institution in London, at once resolved to try whether the evolution of gases from the decomposition of water by the action of the galvanic current might not be applied to telegraphic purposes.

From the time of the above mentioned dinner at the minister's, he gave himself no rest in his endeavours to construct a galvano-chemical telegraph.

On the 6th of August he considered the object of his ardent desire attained. He noted that day: "Tried the entirely finished instrument, which completely answers my expectations." He was then able to work with the telegraph he had invented through 724 feet of wire. Twelve days later he telegraphed through no less than 2000 feet, and on the 29th August, he exhibited his telegraph in action before a meeting of the Academy of Sciences.

He now wished to send his instrument to the National Institute in Paris. On the 4th November, the chief surgeon of the French army, Dominique Jean Larrey, with whom Soemmerring had been long acquainted, came to Munich on his way to Paris from the army, after the battles of Aspern, Esslingen, and particularly at Deutsch Wagram, where Napoleon I. had on the field created him a Baron. Larrey most readily offered to take the telegraph with him, and even assisted at the packing of it.

After his departure, Soemmerring composed a French memoir, describing his invention, which he forwarded to Larrey, in Paris, with a letter, wherein he expressed his hope that he would also exhibit the telegraph to the Emperor.

Dr. Hamel has ascertained in Paris, that Larrey presented Soemmerring's telegraph to the Institute on the 4th of December (1809), and that Biot, Carnot, Charles and Monge were appointed to report on it.

Soemmerring, to his great delight, succeeded in accomplishing on the 23rd of August, 1810, his very ingenious mechanical contrivance for causing the gas-bubbles rising from the wire-points in the water to ring an alarum bell.

Ten days previous to that, on the 13th August, Baron Schilling, then attached to the Russian Mission at Munich, saw for the first time Soemmerring's telegraph. He became enthusiastically fond of the new art of signalising, which promised to become so all-important, and he directed the attention of many other persons to it. In 1811 he introduced to Soemmerring Colonel Count Jeroslas Potocky, who took a telegraph, made for him, to Vienna, and exhibited it on the 1st of July to the Emperor Francis I., in the presence of the Empress and the Archdukes Charles and John. His Majesty expressed the wish to have a telegraphic communication established between Vienna and his country palace, Laxenburg, a distance of nine miles. Baron Schilling was, as stated in the *Journal* a short time since,* the medium by which the British Envoy and Minister Plenipotentiary at Munich, the honourable Frederic James Lamb, brother to Lady Palmerston, and subsequently the second Lord Melbourne, on the 12th of July, 1816, witnessed experiments with Soemmerring's instrument, being the first Englishman who ever saw a galvanic telegraph.

Again, Baron Schilling was the person who, at a later period, made in St. Petersburg the first electro-magnetic telegraph, which he, in 1835, two years before his death, exhibited to the meeting of the German naturalists at Bonn. Dr. Hamel has explained to the St. Petersburg Academy, in detail, how Baron Schilling's telegraphic contrivance found, in 1836, its way from the borders of the Rhine to England, and so gave the impulse to the spreading of that most wonderful application of science, by means of which, ere long, all inhabited parts of the globe will be put in telegraphic intercommunication.

Home Correspondence.

UNIFORM MUSICAL DIAPASON.

To the Secretary of the Society of Arts.

Sir,—I recently drew the attention of Mr. Dilke, the chairman of our Council, to the "Report presented to His Excellency the (French) Minister of State, by the Commission charged to establish in France an uniform Musical Diapason;" and I suggested that the subject of that report might, with advantage, be taken into consideration by the Society of Arts, with a view to determine whether it was desirable and possible to establish, by a voluntary combination, in England, the same uniform Musical Diapason that has been officially established by decree in France.

There was an interesting article on this subject in the *Saturday Review* of the 16th of April last.

You are aware that for a long time the "pitch" of music, being settled by no fixed standard, has been very various and undergoing a gradual rise, so that music written by Handel or Mozart, for example, is now played and sung (say) a semitone higher than Handel or Mozart intended. This rise is injurious to vocalists, having a tendency to strain their voices. In the case of instruments constructed of wood, metal, and fibre, it is of course possible to make almost indefinite advances to a tighter strain and to a higher tone; but the human voice is incapable of being thus raised. It is the same, in its various capacities, in all generations; and, if the prevailing tendency to raise the instrumental "pitch" is not to be checked, the vocal organ will necessarily suffer more and more. At present there seems to be no certainty in music. There are various "pitches" in different countries, and even in the same country. As music is of all countries, and works composed in one land are played and sung in all civilised lands, it appears to be very important that the standard diapason, which has been authoritatively adopted in France, should be accepted in this country and elsewhere if there be no serious objection to it; and it occurred to me that, in the absence of any competent musical authority legally or officially established in England, the Society of Arts might convene a conference of musical magnates, amateurs as well as professionals, composers, instrument-makers, vocalists and instrumentalists, to discuss the subject and to determine whether the Society should frame a resolution, and get it extensively signed, to the effect that the persons signing accepted the French decision, and would use their influence to procure the adoption of the same uniform pitch. By such a measure we might make what would be equivalent to a voluntary law for ourselves; and public opinion, thus expressed, would lead the instrument-makers generally to confine themselves to that standard.

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* *Journal of the Society of Arts*, Vol. VII., p. 235.

The Chairman of the Council, with his usual energy, has submitted my suggestion to various competent persons, and my object in writing to you is simply that, by the publication of my letter in the *Journal*, the opinions of members of the Society may be elicited.—I am, &c.,

HARRY CHESTER.

63, Rutland-gate, London, S.W., 11th May, 1859.

IRON SHIPS OF WAR.

SIR,—In the discussion that took place on Wednesday evening last, after the reading of my paper on "Timber for Shipbuilding," Mr. E. J. Reed made some remarks on the applicability of iron, and iron only, in the construction of ships of war; and as I had not then the opportunity of replying in full, I beg that this communication may be allowed to appear in the next number of your *Journal*.

Mr. Reed, selecting a passage in my paper, undertook to controvert the opinion I had therein expressed; and, in so doing, opened up that great and comprehensive question, "Is wood or iron the better material for war ships?"

Now, this is really a point admitting of so many arguments, that I shall have a difficulty in dealing with it in the brief compass of a letter such as you can find room for in your Journal. I shall attempt, therefore, to grapple only with a few of the most important considerations which present themselves to the mind in connection with this question.

Every reader of the public journals is fully aware of the opinion expressed in Parliament by Sir John Pakington as to the necessity of our building two, four, or even six iron-plated ships of war, because our amiable allies, the French, were doing so. But Mr. Reed tells us that it has now "become perfectly evident that the most efficient method of constructing the shot-proof frigates would be to build them wholly of iron;" and that "this has been fully decided upon." The reason given for this unusually prompt decision is, that "it would not, of course do, in these days of explosive shells and liquid fires, to leave any portion of a wooden ship exposed; consequently, the resort to iron alone became absolutely necessary!"

Accepting this, then, as the true "reason," we will examine its bearings a little more closely, and see what deductions can be drawn from that examination.

"Kill, or be killed" would appear to be the natural motto for warriors, whether fighting on land or by sea; but in reality, few soldiers or sailors would so far give the lie to human nature as to forego all prudential and discretional consideration of self. During the last great naval war such things as "explosive shells" were well known, and often employed; but even a far more dangerous missile, viz., red-hot shot, was also known, and had, in certain cases (such as the defence of Gibraltar) been employed with most destructive effect against ships of war; and yet I cannot recal any instance of red-hot shot being used in naval warfare, ship against ship.

Why was this not done? Why was this most destructive mode of attacking wooden ships not adopted by the navies of the world, in their combats with each other, during that great death struggle?

Certainly one reason was that it was held to be unfair—dastardly—and as affording no chance whatever to combatants on the remorseless deep. It was like two duellists placed within arms length, and their pistols touching each other's breast. It was almost certain death to both. It was, in fact, the fighting of brave men degenerated into cold-blooded murder. Hence its rejection.

Then, again, how could "Jack" obtain any prize-money? or how could admirals, captains, officers, and crews gain "honour, glory, and renown?" The employment of red-hot shot was evidently not considered an improvement in naval warfare; and the question is, will "liquid fires" be adopted by any civilised nation in naval engagements that may be fought in our time? It is a strange game at which two cannot play; and it strikes me as being pretty certain, that if such indiscriminate modes of destruction are resorted to in navies, very short work will be made of all ships engaging in battle.

But let us come to war-ships built wholly of iron, and examine their merits and demerits. The avowed object is to make them "shot and shell-proof," by using thick metal so as to resist their penetrating powers. Now, to accomplish this aim, it seems clear to my mind that so great a mass of metal must be employed that its weight would prevent the vessel from floating, even without her armament and crew, her provisions, engines, and coal. Build her of steel, if you will, but you cannot get rid of this fatal objection; for as with hardened iron projectiles, iron plates may be penetrated, so with steel projectiles, the best steel plates may be pierced.

A soft tallow candle, projected from a gun within a certain range, will pass clean through a deal board of an inch thick, and under similar (and even much more favourable circumstances) iron will pass through iron, and steel through steel.

But this is by no means the danger incurred by an iron ship. It is rather the battering power which may be brought to bear upon its thick iron plates, starting the rivets or bolts which hold them together, and rending open large portions of the ship's side at one single broadside.

Most men have some idea of the powerful effect of Nasmyth's ponderous steam hammer; but what is it in comparison with the force of a 68-pounder? Take Armstrong's gun, or any similar cannon of adequate size, and the percussive force will be greatly increased; now, come to direct the concentrated fire of ten or twenty such cannon on any one or even two plates of an iron or steel ship, and what would her condition be three minutes afterwards.

Nothing that would float (in the present form of a ship) could possibly withstand such a concentrated fire. Let the French Emperor and Sir John Pakington try this experiment, and they will find that they have not yet arrived at that great desideratum, viz., "an impregnable ship."

Mr. Reed said to the members of the Society, "those present might judge for themselves what would be the effect of half-a-dozen shell-proof frigates making their appearance among a fleet of our wooden ships," and, with all respect to Mr. Reed, I will answer that inquiry, by declaring that those six redoubtable frigates would be boarded and carried at sword's point in "less than no time," unless, indeed, our tars have greatly degenerated.

If this be deemed a bold and unsupported assertion on my part, take the opinions of the dashing Dundonald, the undaunted Napier, and ninety-eight other "British hearts of oak," and see how many of them will contradict and how many will confirm that assertion. But that this would be the case seems evident on the very face of it, for the following reasons:—These iron and so-called shot-proof vessels would necessarily be so heavy and so slow in their motions, even with great steam power, that "our wooden ships," with far less steam-power, could easily overtake them, run away from them, steam round them, or run them aboard just as they pleased; and in the last case would inevitably carry them by "boarders." True, the wooden ships so boarding might be grievously injured by their opponents; they might even be entirely destroyed, but this result would be too late to save the iron ships from capture.

I might, perhaps, with some reason allude to the various inventions which may be tried to prevent boarders reaching the deck of iron and other ships; but, fortunately for us, our excellent friends the French entertain a very complacent and comfortable opinion of their own peculiar irresistibility as "boarders," and until further experience shall have had the effect of disabusing their minds on this point, they will probably scorn the aid of such protective inventions. Our gallant tars, armed with sharp cutlasses and good revolvers, may therefore yet have many opportunities of "trying their metal" in the way of boarding.

It would be well to give due attention to the fact that shot holes in a wooden ship can easily be plugged up. Indeed, instances have occurred in which one or two carpenter's mates have been lowered over the ship's side during action, and remained there plugging up the shot holes as fast as they were made. Over shot-holes so plugged up it is usual to nail pieces of board or plank, which keep the ship water tight until she can be brought into port. Upwards of sixty years ago, one of our ships (the *Leander*, I believe) had 64 most dangerous shot holes on one side; but although there was a heavy sea running at the time, and she was in imminent danger of foundering, yet these holes were all eventually plugged up, and planks nailed over them, and, by this means, she found her way home, crippled and disabled as she was.

Now to plug up a shot-hole in an iron ship is no such easy matter, partly from the jagged and irregular nature of the hole or rent itself, and partly from the want of adhesion between the iron and the wood; whilst the additional safeguard of planking over the plugged holes could not possibly be effected. During the Chinese war, in 1843-44, this was clearly shown in the case of the *Queen* and one or two other iron war steamers belonging to the Indian Navy.

I have touched but very briefly indeed upon the chief points that may be urged against the suitability of iron ships for warlike purposes; but I think I have said enough to convince any unprejudiced mind that very much indeed remains to be proved before the country can place any well-grounded faith in such ships.

I did not lightly hazard the opinion which Mr. Reed has attempted to refute; on the contrary, it is the conviction I have arrived at after maturely studying the question in all its bearings; and I trust that our Government, and the public at large, will "read, mark, and carefully digest" the remarks contained in this communication. I fully agree with Sir John Pakington that, as the French are building thick iron-plated ships of war, we also must have them, and if possible with every available improvement.

I am much pleased that Mr. Reed has opened up this question for discussion, as it tends to elicit opinions and facts which may have much practical value.— I am, &c.,

LEONARD WRAY.

Clapham, May 10th, 1859.

P.S.—In the published Report of the Chairman's remarks (in the Discussion) I detect a slight error, viz., that "Sugar brought over in them (iron ships) was deteriorated," &c. What he said was, "Such articles as sugar and guano acting injuriously upon them, and causing great deterioration."

I am sorry I cannot now reply to Mr. Howard's inquiries further than by saying, that saws to cut up "blue gum trees" into planks 14 feet wide can be as easily made as those for sawing planks only 5 feet wide. L. W.

SHIP TIMBER AND SHIP BUILDING.

SIR,—The subject so ably treated by Mr. L. Wray must ever be of great interest to Englishmen, and I have penned the following observations from notes made at various times on the question of timber supply for the navy and merchant marine, in the hope that some of the Colonial members and friends of the Society will follow up the subject, by favouring us with such information as their local knowledge may enable them to impart, as to the sizes and qualities of timber in their respective districts, conveniences of loading, &c.

In the discussion upon the paper, reference was made to ship-building in New Zealand, on which I would observe that, by the return last received, it appears that that young colony possessed, at the close of the year 1857, one hundred and eighty-six vessels, averaging 35 tons register, nearly all colonial build; hence, it may be safely affirmed that ship-building has taken root there as a manufacture.

The reason so many of our distant colonies confine their building to small coasting vessels is simply this, that the necessary iron-work for large ships is so costly; and in this respect our North American colonies have a standing advantage over them, because the wood-work being put together in North America, the vessels are sent to England, either timber laden or in ballast, to be finished, and for a short voyage, with prevalent favourable westerly winds, there is no danger in this practice, whereas for the more distant East, or Australia, the strain upon a slightly fastened ship would be dangerous, and therefore vessels built in those colonies must be finished there.

With regard to bringing home cargoes of timber, it must be borne in mind that timber does not carry well with other goods; if you load timber at all, generally speaking the cargo must be all timber.

From Canada and the Baltic, vessels can make two voyages in the season, and consequently can afford to carry at low freights; and the pine being easily workable and cheap, is a pet (rather too much so) with house builders, and therefore every crevice in the hold is filled up with a plank or joist, some even but a few feet in length, and an inch or so in thickness. But an Eastern or Australian vessel can do very little more than one voyage in the year, and, to pay equally well with the Canadian vessel, should receive double freight at least; the more so as, for various reasons, a higher class of ships is almost essential for employment in the Southern trade. Hence only the more valuable woods can bear the charges. There is also another very important element entering into this question, and that is the enormous difference in value per load which size imparts to ship building timber, particularly pieces suitable for masts and bowsprits.

Judging from several instances which have come under my notice, Government sets the example—and there is probably good reason in the matter—of paying a much higher price per load for large pieces than for those of smaller dimensions. I have before me a list of a cargo of timber from a distant colony, supplied to the Government; and, speaking roughly, I may say those under 45 feet in length did not pay expenses; from 45 to 60 about cleared themselves; those above 60 realised fair profit, every five feet greatly increasing the value.

But no vessel can be laden with all large pieces; if she is sufficiently spacious to take long pieces in the bottom there will be waste in the upper parts of the hold; if small pieces are shipped they will barely pay. Again, timber ships require bow and stern ports to be cut, which I apprehend would sadly weaken some of our Australian clippers; moreover, they could not load at the port of discharge, neither Melbourne nor Sydney being timber ports, and I fear Western Australia would not find much favour, being on the weather side of the coast, and transhipment would be too expensive an operation.

What sort of a freight would Mr. Wray make out of pieces such as the blue gum he mentions, 14 feet wide and 120 feet long? How are such pieces to be conveyed to a good safe port? How would he load and stow such pieces? How he would weaken his vessel by cutting sufficiently large ports at stem and stern.

New Zealand does not possess any large quantity of very durable wood for the hulls of vessels, but at several ports in that colony unsurpassed pine spars could be obtained; at Hokianga, Kaipara, Wangaroa, and Mercury Bay, by a few preliminary arrangements being made. So many masts are likely to be required for gun-boats, and topmasts for larger ships, that it is of national importance to husband our resources, for the New Zealand forests are limited in extent. Small trees are frequently recklessly cut down, which in a few years would make valuable masts.

It would be well if the Government and shipbuilders would publish, in some accessible and convenient form, the sizes of different sorts of wood most in repute for the respective purposes for which they are applied; and Lloyd's Committee could not do a better service to our timber colonies than assist in such a cause, from views of cheapening the cost of home-built good ships, as well as benefiting the colonies.

I knew a young merchant, who, being on the point of departure for one of our timber colonies, after hearing my remarks as to the importance of meeting the Government requirements in reference to size, which had come to my knowledge as a matter of fact, spent several days in the vain endeavour to obtain from the Admiralty some rough idea of the relative appreciation of different sizes, and although not readily daunted, he never could procure the information, and therefore departed without this desirable knowledge.

The value of this knowledge will be understood by all who have dwelt amongst "hewers of wood," whose beau-ideal of beauty is a clean well-squared log, in accomplishing which a large slice of valuable timber is frequently severed from the tree and wasted; many an inch, or even two, in the dimensions could often be saved, if its importance were understood.

I would inquire, with reference to timber-preserving solutions, whether any one has been found so objectionable to rats as to prevent those destructive vermin making the ship their home.

When iron ships were first proposed, the building in compartments, as affording great additional security against fire and total wreck, was held out as an important element.

Has this been justified by experience?

As to the question of the much-dreaded irresistible iron ships building by our French neighbours, I may observe that it is admitted that they must necessarily be comparatively slow in speed, and if, as suggested, "half-a-dozen shell-proof frigates were to make their appearance among a fleet of our wooden ships" it might not be improbable that the latter might, as it would certainly be their duty to, get not away, but alongside as quickly as possible, and board them, thus possessing ourselves of these best specimens of ready-made iron ships as our fathers did the best models of sailing ships. I merely suggest the possibility of such an occurrence.

There not having been a sea-fight between nations at all upon a par since auxiliary screws have been introduced into our war department, it is uncertain to what advantages or disadvantages, steam in naval warfare may have rendered us subject, but so far as the mercantile marine is concerned, steam for long trips, unless subsidized, seems too expensive a mode of propulsion.

For coasters and short voyages, where punctuality to a few hours and quick despatch are important, and passengers are numerous, steam may answer, though I believe many concerns of this class would not endure a very strict investigation.

It is easy, by ignoring altogether or dealing gently with the subject of depreciation in value, transferring repairs to next year, &c., to make a tolerable show of earnings and declared dividend. In one instance, which came under my notice, a dividend was principally made up of two items—the sale of an old vessel and the proceeds of surplus stores sold to the agents of the company.

In some of these modes the capital is eaten into and consumed, and the trick of prosperity goes on for a varying length of time.

It appears to me that where bulky goods, as coals, timber, or corn, are to be conveyed, steam cannot be profitably available even for short distances, and certainly not for long voyages. Produce, whether sugar, cotton, wool, or rice, comes to maturity periodically, and the small difference in time of arrival at market between steam and wind-propelled craft, will seldom compensate for the payment of the extra freight by steam.

At the same time I admit and consider it sound policy to subsidize ocean steamers on various main lines, because it is important to the whole community to know that certain supplies are on the way; the information may bear the price of steam, although the goods themselves may not.

The experience of all the attempts to establish a steam line of vessels to India and Australia, *via* the Cape, tends to show that for long lines steam cannot compete with the wind.

It is well known that for a long portion of the voyage tolerably fair winds may be depended upon, the N.E. and S.E. trade and west wind, when round the Cape of Good Hope; similarly from Australia to Cape Horn, a reasonable amount of fair wind may generally be reckoned upon. To use the screw just to clear the channel when the wind is foul, and push across the line between the trades, necessitates the expense of outlay for steam machinery and permanent staff of engineers, hardly compensated by the advantages; moreover, I think it would not be difficult, if regard to your space did not prevent the attempt, to show that there are lines of sailing vessels to India and Australia which perform their passages with much greater regularity, and in not longer times than steam auxiliaried vessels.

While on this subject, I may be permitted to add that the sad failures in the Australian Mail Service are to be attributed to the attempt to overtask steam machinery, rather than to the bad quality of the ships employed.

An inspection of the map will show that a mail steamer, whether from London to Melbourne direct, or from Melbourne to Suez, *via* either Mauritius or Galle, is expected to perform, without stopping, more than double the work of any other line. In the case of the North American lines, there is Ireland on the one side, and Newfoundland on the other, to be run for on any emergency, and the distance from a port of refuge is never more than a few hundred miles; and in the South American and West India lines, there are Spanish and Portuguese ports, besides Teneriffe, Madeira, &c.; but from King George's Sound to Galle or Mauritius, there is no port in case of an accident or break-down, and no resource but to run back the whole distance.

The small island of St. Paul's is the only land *en route*, and it possesses no ship harbour nor even a safe anchorage at all times; it might, however, have a coal depot for great emergencies.

This important mail service will never be satisfactorily performed, I fear, until the route from Sincapore *via* Torres Straits is adopted, the long journey from Melbourne to Suez, *via* Mauritius, against the prevalent wind and a dead heavy sea, being especially calculated to interfere with the punctuality of the homeward arrivals.

I am, &c.,
WILLIAM STONES.

FREE LIBRARIES.

SIR,—On most great questions where a difference of opinion exists, there is much to be said on both sides, the differences commonly arising from the different points of view at which it has been considered. The facts which warrant the conclusion on one side, may be met with facts which justify an opposite opinion, and this, I believe, to be the case with reference to the good or evil of Free Circulating Libraries.

Your correspondent, Mr. John Watts, cites Manchester as a case in point, and might have included Liverpool, as in neither town has the existence of a Free Library been detrimental to a Mechanics' Institute; but the same argument will not apply to the majority of other towns, where there is not the same amount of population, nor the aid of the wealthy, to make a Mechanics' Institution successful. Yorkshire, with its 150 Institutes, may surely have some claim to be heard on this question, and experience justifies the assertion that a Free Library is not compatible with a successful Mechanics' Institute, and that as the latter is by far the most valuable aid to popular education, the former ought not to be an impediment.

I am unaware of deserving the imputation of your correspondent, of making use of the old voluntary educationists' arguments, inasmuch as the object of my remarks was to advocate the support of Mechanics' Institues with especial regard to the preservation of that independence which is the distinguishing characteristic of the industrious classes of Yorkshire. The chief difficulty is to convince them of the advantage and necessity of mental cultivation, for which they have no objection to pay; nor would they willingly accept it as eleemosynary aid. This may be shown by the fact that in almost every instance an increase of the rate of subscription has been followed by an increase in the number of members. Unfortunately, however, in too many cases it has been found that the receipts are inadequate for the inevitable expenditure, and reliance is necessarily placed on the payments from members who are solely attracted by library or reading-room, an advantage of which the Institute would be deprived if a Free Circulating Library existed in the same town.

With reference to Sheffield, it may be true that the decline of the Institute dated from an earlier period than the establishment of the Free Library. The money for the building was injudiciously expended. The Lecture-hall was made handsome enough for a Chamber of Deputies; the class-rooms were placed above it, and it required more zeal for instruction than the young men of Sheffield possessed, to induce them to mount 90 stairs to obtain it. This difficulty might, however, have been overcome, had not the establishment of a Free Library deprived the Institute of an important element in the attraction of subscribers.

The remark as to the estimation of a token of affection or gratitude is unworthy of the writer. My observation had sole reference to the value ordinarily placed upon advantages placed within the reach of the people generally. Many instances might be shown where not only libraries but classes for instruction by competent teachers are offered gratuitously by the munificence of individuals, and yet they are not appreciated by the working classes, because they are free. It is well known that in most Institutes where class fees are payable, such classes are better attended than where they are free; and I believe a similar feeling exists wherever the working people take a pride in being independent of what they believe to be charity. As the old story of the self-willed boy, who replied, "The more you call, father, the more I won't come," so there are many who refuse all solicitations to benefit themselves except at their own cost. If, therefore, you deprive Mechanics' Institutes of the aid which a library affords them by establishing a rival without cost, a certain amount of injury is inflicted without a corresponding amount of good. There was a time when a good Free Library would have been of incalculable benefit, and even now, if confined to works of reference and of value beyond the reach of ordinary means, they would prove of important service, but wherever they are placed in competition with a Mechanics' Institute, they are more likely to supersede than to supplement its operations, and will probably result in confining all literary exertion to the mere reading of ephemeral publications.

The great end and aim of Mechanics' Institutions is to train the mind of the rising generation to the pursuit of definite objects of study, in which material assistance may be rendered by the Examinations of the Society of Arts. In the furtherance of such an object it is desirable that those who are benefited should as far as possible rely upon themselves, receiving only such aid from the wealthy as contributions to the cost of a building, donations to the library, and subscriptions as members, all of which betoken the sympathy of one class with the other; but as, even with such assistance, great difficulty is often experienced in making a Mechanics' Institute self-supporting. The middle classes, by subscribing for the use of the library, help to supply the deficiency, and the classes for the poorer members continue to be maintained.

I am, &c.,

BARNETT BLAKE.

Leeds, May 10, 1859.

Proceedings of Institutions.

GLASGOW ATHENÆUM.—Mr. M'Kinnell has intimated to the directors of the Athenæum his intention of resigning the secretaryship of that Institution in May next; and in accepting his resignation the Board has cordially and unanimously elected him a life member, in acknowledgment of his lengthened and efficient services.

MEETINGS FOR THE ENSUING WEEK.

MON. ......British Architects, 8. Mr. T. Hayter Lewis, "On the Construction of Domes."

TUES. ......Royal Inst., 3. Professor John Morris, "On Geological Science."

Civil Engineers, 8. 1. Mr. C. E. Amos, "On the Origin, Progress, and Present State of the Government Water Works, Trafalgar-square." 2. Hon. John Wethered, "On the Use of Combined Steam."

Statistical 8. 1. Mr. Welton, "On the Occupations of the People of England and Wales; Part II." 2. Mr. Acton, "On Illegitimate Births in the parishes of Marylebone, St. Pancras, and St. George, Southwark."

WED. ......Pathological, 8.

Pharmaceutical, 12 a.m. Anniversary.

Society of Arts, 8. Mr. B. Fothergill, "On the Relative Values of Coal and Coke in Locomotive Engines."

Geological, 8. 1. Sir P. Egerton, Bart., "On the Nomenclature of the Old Red Fishes." 2. Rev. J. Anderson, "On the Yellow Sandstone of Dura Den, and some of the Old Red Fishes."

Ethnological, 8½. Anniversary.

THURS ......Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."

Royal Soc. Club, 6.

Antiquaries, 8.

Chemical, 8.

Royal, 8½.

FRI. ......Royal Inst., 8½. Dr. J. H. Gladstone, "On the Colours of Shooting Stars and Meteors."

SAT..........Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."

Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. NO.

Delivered on 9th and 11th April, 1859.

196. Metropolitan Buildings Act—Returns.
197. Queen's Colleges (Ireland)—Return.
199. Expiring Laws—Report from Committee.
92. East India (Railways)—Corrected Pages of Return.
103. Bills—Naval Medical Supplemental Fund Annuities, &c., Act Amendment
104. ,, Lunatic Poor (Ireland) (as amended by the Select Committee).

105. ,, Confirmation and Probate Act (1858) Amendment.
106. Convict Prisons Abroad.

Delivered on 12th April, 1859.

188. Weights and Measures—Copy of a Letter.
201. Cities and Boroughs (Taxation)—Return.
98. Bill—Belfast Borough.

Delivered on 13th April, 1859.

189. East India (Financial Despatches)—Return.
206. Standing Order for the Suspension of Private Bills.

Delivered on 14th April, 1859.

190. East India (Finance)—Account.
205. Jews' Act—Report from the Committee.
211. Electoral Act (New South Wales)—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 6, 1859.]

Dated 12th April, 1859.

911. D. Doig, Manchester—Imp. in the construction of gas lamps. (A com.)

Dated 18th April, 1859.

967. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved machine for raising water. (A com.)
969. W. Prosser, 24, Dorset-place, Dorset-square—Imp. in apparatus employed in the production of light.
971. J. Whitaker, Bedford Mill Iron Works, near Leigh, Lancashire—Imp. in mowing machines.
973. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved disinfecting compound. (A com.)
975. J. Izod, 58, High street, Hoxton, Middlesex—A safety cigar, vesuvian, or fusee box or case.
977. J. Freer, Rothley, Leicestershire—Imp. in machines for planting grain and seed, and an improved seed feeder and meter for planting machines.
979. A. Dalrymple, Sheffield—Imp. in the mode of covering crinoline, and in machines used in connection therewith.
981. F. Edwards and W. Edwards, Coventry—Imp. in looms for weaving ribbons and other like goods.
983. J. Boydell, Gloucester-crescent, Regent's-park—Imp. in the apparatus applied to the wheels of locomotive traction and other carriages to facilitate the draught.

Dated 19th April, 1859.

985. P. Reynolds and J. Reynolds, Belfast, Antrim, Ireland—Imp. in machinery or apparatus for hackling flax and other fibrous materials.
987. I. Dutton, Tipton, Staffordshire, R. Martin and T. Phillips, Dudley, Worcestershire—New or improved machinery for preventing accidents in coal or other mines, by the drawing of skips or cages over their pullies.
989. O. Maggs, Bourton, Dorsetshire Imp. in cheese presses.
991. A. V. Newton, 66, Chancery-lane—Improved machinery for weaving seamless bags or other articles with hemispherical or regular or irregular ends or forms. (A com.)

Dated 20th April, 1859.

993. J. Wotton, Birmingham—An imp. or imps. in raising or shaping metals.
995. A. W. Williamson, University College—Imp. in obtaining extracts from the liquorice root.

Dated 21st April, 1859.

999. A. F. Vanhulst, Brussels—An improved kiln for drying malt.
1001. T. Dawson and J. Avery, 32, Essex-street—Imp. in pencil-cases, watch seals and keys, toothpicks, and other like articles of jewellery, lockets, penknife handles, portemonnaies, and other like articles.
1003. J. Alison, Hainault Forest, Essex—An improved instrument for extirpating thistles, docks, and other deep-rooted weeds.
1005. D. Auld, Glasgow—Imp. in machinery or apparatus for supplying steam boilers with water.
1007. E. Lewthwaite, Halifax, and G. Ambler, Queenshead, near Halifax—Imp. in clocks, watches, chronometers, and other timekeepers.
1009. G. Roberts and J. Bridges, 20, Ponsonby-place, Vauxhall Bridge-road—Imp. in the manufacture of candles.
1011. J. H. Pepper, Morton-house, Kilburn Priory—Imp. in apparatus for showing stereoscopic pictures.

Dated 23rd April, 1859.

1013. R. Gray, Sheffield—Imp. in crinoline skirts. (A com.)
1015. J. Edwards, 77, Aldermanbury—Imp. in the manufacture of buttons.
1017 J. Gillies, Glasgow—Imp. in branding or marking wood for casks, barrels, and other purposes.
1019. W. Dicks and W. Hopwell, Leicester—Imp. in machinery for making screws, and applying them in fixing the soles of boots and shoes.
1021. P. F. Mutel and L. H. Blanchard, Paris—Imp. in gas burners.
1023. W. Gibson, St. Leonards-road, Middlesex—Imp. in steering apparatus.
1025. J. Marshall, jun., Selby, Yorkshire—Imp. in filtering and depurating fluids.
1027. F. C. Maguire, Stamford—Certain imp. in the utilisation of sewage manure.

Dated 25th April, 1859.

1029. W. P. Balfern and M. McKay, Hammersmith—The manufacture of sweet figged soft soap.
1031. G. Ward, Blackburn—Imp. in machinery or apparatus for making healds.
1033. T. A. Weston, King's Norton, Worcestershire—A new or improved pulley.
1035. J. Holmes, Street, Somerset—Imp. in applying eylet holes to boots and shoes and in binding boots and shoes.
1037. E. Humphrys, Deptford—Imp. in steering apparatus.
1039. H. C. Hurry, Wolverhampton—Improved means of and apparatus for obtaining motive power.
1041. S. L. Taylor, Cotton End, Bedfordshire—Imp. in agricultural implements in obtaining motive power for actuating such implements, and in apparatus connected with the application of steam power.

Dated 26th April, 1859.

1043. H. Allman, Mornington-place, Hampstead-road—Certain imp. in the construction of window-blind mountings, and in apparatus connected therewith.
1045. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of nitric acid, and its application for the production of artificial nitrous or nitric salts. (A com.)
1047. W. Marshall, Leith Walk, Mid-Lothian, N.B.—Imp. in steam engines.
1049. R. A. Brooman, 166, Fleet-street—Imp. in steam boilers. (A com.)
1051. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for grinding and polishing knives and other articles of cutlery and tools. (A com.)

Dated 27th April, 1859.

1053. G. Pearson, Bugbrook, near Weedon, Northamptonshire—Imp. in apparatus for cutting and shaping trenails.
1055. H. R. Fanshawe, 13, Russell-place, Old Kent-road—Improved apparatus or mechanism for drawing-off, filtering, and guaging liquids in butts, barrels, casks, and such like vessels, preserving the contents from deterioration from contact with atmospheric air.
1057. J. R. Smith, Glasgow—Imp. in obtaining motive power.
1059. C. Hamp, Harrow-road—Certain imp. in locks.
1061. T. Lacey, Grafton-street, Westminster—Imp. in gas regulators.
1063. T. Gauntley, sen., High Pavement, Nottingham—Imp. in the manufacture of fringes.

INVENTIONS WITH COMPLETE SPECIFICATION FILED.

1075. W. M. Cranston, 11, New Broad-street—A grass-cutting machine. (A com.)—April 29th.
1110. J. Morse, Massachusetts, U.S.—An improved power printing press.—May 3rd.
1111. L. R. Blake, Massachusetts, U.S.—A new and useful or improved machine for sewing a sole on a boot or shoe.—April 3rd.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, May 6th*, 1859.]

May 6th.

2482. A. Fryer.
2490. J. Platt.
2494. A. H. Dendy.
2496. T. MacSweeney.
2497. W. Hale.
2502. E. E. Allen.
2504. J. F. Dickson.
2505. J. L. Jullion.
2507. A. Henderson.
2508. J. Felix.
2515. R. A. Brooman.
2516. R. M. Ordish.
2522. E. Humphrys.
2528. J. Blethyn.
2531. F. H. Maberly.
2535. J. Rae.
2545. J. Wadsworth.
2555. A. B. Woodcock and J. M. Dunlop.
2566. W. Clark.
2567. W. Clark.
2599. C. Cowper.
2675. Jozé Luis.
2683. Jozé Luis.
291. M. Loam.
303. I. Clements.
391. J. Grimes.
527. J. Leigh.
569. H. Leonard.
628. N. Washburn.

[*From Gazette, May 10th*, 1859.]

May 10th.

2258. J. Saxby.
2518. J. Corner.
2520. W. G. Taylor.
2524. A. J. Brooks.
2527. T. C. Judkins.
2534. T. Gray.
2542. G. T. Bousfield.
2546. W. Ashton & T. Cartmell.
2560. T. R. Butcher, F. Stevens, W. T. Johnson, and T. Jarvis.
2588. M. Scott.
2594. J. Platt and H. Chubb.
2604. J. Leslie.
2630. T. S. Cressey.
2666. A. V. Newton.
2692. W. Richards.
2700. H. L. Pattinson.
2784. W. E. Newton.
3792. J. Dawson.
2964. R. Hornsby, jun.
380. B. Burrows.
570. W. Tucker.
580. J. Leigh.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

May 4th.

1057. W. Bulmer and I. Sharp.
1068. R. A. Brooman.
1071. W. J. Curtis.
1102. R. A. Brooman.

[*From Gazette, May 10th*, 1859.]

May 5th.

1088. A. V. Newton.
1287. A. Watson and A. H. Williams.

May 6th.

1113. B. Beniowski.

May 7th.

1076. L. G. Perreaux.
1095. F. Potts and T. Vann.
1099. W. Basford.
1101. G. Simpson.

Journal of the Society of Arts.

FRIDAY, MAY 20, 1859.

CONVERSAZIONE.

The Second Conversazione of this Session will be held on Saturday evening, the 28th inst., at the South Kensington Museum, the card for which will admit the member and two ladies, or one gentleman. These cards have been issued.

EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th ult., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

OPENING OF GALLERIES OF ART IN THE EVENING.

Since the publication in last week's *Journal* of the letter from the Trustees of the National Gallery in answer to that addressed to them by the Council of the Society of Arts on this subject, the following further reply has been received from that body :—

National Gallery, 17th May, 1859.

Sir,—In reply to the suggestion that the National Pictures should be exhibited to the public in the evenings, as well as by day, I am directed to state that the pictures which are about to be deposited temporarily at South Kensington, being totally distinct from the collection of the South Kensington Museum, will necessarily continue subject to the arrangements which have hitherto been invariably observed at the National Gallery.

I am, Sir,
Your obedient Servant,
R. N. WORNUM,
Secretary, &c.

The Secretary, Society of Arts, Adelphi.

TWENTY-THIRD ORDINARY MEETING.

Wednesday, May 18, 1859.

The Twenty-Third Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 18th inst., Sir John Rennie, F.R.S., in the chair.

The following candidates were balloted for and duly elected members of the Society :—

Battam, Thomas, Jun.
Edenborough, S. Bolton
Hancock, Walter
Harman, Thomas
Hollingshead, J.
Silver, Hugh Adams
Wood, Vice-Chancellor Sir W. Page

The following Institutions have been taken into Union since the last announcement :—

Chelsea, Athenæum.
Sheffield, Literary and Scientific Institution.

The Paper read was—

ON THE RELATIVE VALUES OF COKE AND COAL IN LOCOMOTIVE ENGINES.

By Benjamin Fothergill.

Having attended a meeting in the Society's rooms, on 2nd December, 1857, and taken part in the discussion relating to the use of coke and coal in the furnaces of steam-engine boilers, I then undertook to lay before its members the results of a series of experiments which I had made with coke and coal in locomotive engines in corroboration of the truth of my assertions:

First, that coal was decidedly superior to coke in respect to heating power, and consequently more economical;

Second, that a plentiful supply of steam could be generated by the use of coal for working engines at high velocities and for drawing heavy trains;

Third, the capabilities of coal-burning engines for consuming their own smoke; and,

Fourth, the increased durability of fire-boxes and tubes when coal was used.

On that occcasion I stated that my experiments had been conducted upon the London and South Western Railway, and were made, at the request of the directors, to ascertain the value of an invention which had been patented by their Locomotive Superintendent, Mr. Joseph Beattie. This contrivance will be readily understood by referring to the drawings on the walls, where the fire box is shown in section, divided transversely into two compartments by an inclined water space mid-feather or diaphragm, and a dependent water space hanging from the roof. Both compartments are arched over with fire tiles at narrow intervals apart. The boiler is constructed with a combustion chamber, extending to about one-half its length, and it has a vertical mid-feather or diaphragm in the centre running parallel with its sides. The other half is supplied with tubes in the ordinary manner. The object of this contrivance is to increase the amount of direct heating surface and to diminish the indirect or tube surface, whilst the combustion chamber affords sufficient space for the introduction of a series of fire tiles, for the purpose of retaining a portion of the heat given off from the combustion of the gases in the fire box, and for diffusing the unconsumed carbon, as well as effecting a complete mixture of the air with the gases, and thereby producing a mass of flame which is brought in contact with the direct heating surface of the combustion chamber before it enters the tubes, at the same time preventing practically such an escape of smoke from the chimney as could be deemed a nuisance.

The back or first furnace is the most actively worked, the second being intended to carry incandescent fuel. The ash pans are furnished with dampers for the admission of air when necessary; and this is also admitted through the small apertures in the fire doors and through hollow stays in the fire box.

In addition to the mechanical contrivances referred to, Mr. Beattie has another of considerable importance for using a portion of the exhaust steam for heating the feed water before it enters the boiler, and, as I have tried both his contrivances for this desirable object, I need only refer to the one represented on the drawing, which shows the pipes for conveying the water and steam to the tank under the foot-plate of the engine, from which the feed-pumps receive their supply. The water is received on to a perforated plate in this tank, and in its descent comes in contact with and condenses the steam, and thereby becomes heated; the supply of water is regulated by the ball-tap or valve, and the steam is admitted or shut off whenever the engine driver has occasion to supply or shut off the feed-water to the boiler.

In the course of my first series of experiments, I have used the feed-water supplied by Mr. Beattie's apparatus, at a temperature of 196°.

I may here observe that I was anxious to obtain an analysis of the fuel used by the London and South Western Railway Company, and the more so as I found that they manufactured their own coke from "Ramsay's Coking Coal" (Newcastle), which is of a superior quality; and as it was desirable to ascertain, as far as possible, whether the coke or the coals which were supplied to me contained the greatest amount of sulphur, I sent samples of each to Mr. Dugald Campbell, Analytical Chemist to the Brompton Hospital, and he, after a careful examination, furnished me with the following statement, viz.:—

"The samples I received were four in number, and marked as follows:—

No. 1.—Ramsay's coking coal.
No. 2.—Coke.
No. 3.—Llanguathog Merthyr, shipped Swansea, Neath, and Cardiff.
No. 4. Griff coal.

"No. 1.—Ramsay's Coking Coal

is of a jet sparkling appearance, and is broken up without much difficulty by the fingers into rather thick layers, between most of which are thin plates of iron pyrites, which, I may state, is a compound of iron and sulphur, in the proportion of one of the former to two of the latter. When the coal is reduced to a very fine powder—in which state it is required for analysis—its jet black appearance gives place to a considerable brown tint, which indicates it to be of a bituminous character.

"This coal is rather above the usual density of Newcastle coal, being 1,279, water taken as 1,000.

"The analysis in 100 parts is as follows:—

Carbon	85·57
Hydrogen	5·68
Oxygen	3·07
Nitrogen	1·48
Sulphur	1·46
Moisture	0·74
Ash	2·00
	100·00

"The calorific value of a substance is generally estimated in two ways; firstly, by calculating from its ultimate analysis what quantity of water a known weight of the fuel would evaporate from 212° Fah.; and, secondly, by ascertaining how much oxide of lead is capable of being reduced to the metallic state by a known quantity of the fuel.

"These experiments when conducted upon the different specimens of fuel under precisely similar circumstances, which has been the case in this instance, give results extremely useful for comparing the economic value of the fuel. By such means, 1lb. of No. 1 Ramsay's coking coal was found to be capable of evaporating 15·18lb. of water from a temperature of 212° Fah., and 1lb. of reducing 34·99 lbs. of metallic lead from the oxide.

"No. 2.—Coke made from Ramsay's Coking Coal.

"The specimen I received of this substance was a thin column, which, from its appearance, must have occupied a space from the top to the bottom of the coke in the coking furnace. An average sample was selected from this for examination, and the results obtained were as follows:—

"Density of coke 1,055, water being 1,000. The analysis in 100 parts.

Carbon	86·91
Hydrogen	1·32
Oxygen	0·10
Nitrogen	0·80
Sulphur	1·94
Moisture	1·28
Ash	7·65
	100·00

"One pound of this coke is capable of evaporating from 212° Fah. 12·78lb. of water; and 1lb., of reducing from the oxide of lead, 31·35lb. of metallic lead.

"No. 3.—Llanguathog Merthyr.

"This coal has a bright sparkling appearance, resembling to some extent (No. 1) Ramsay's coal; but it is rather more dense, and not so easily broken; when broken however, the layers are not so thick, and between them no iron pyrites are visible, but thin plates of silicate of lime are occasionally noticed.

"Density of coal, 1,333; water 1,000. The analysis in 100 parts.

Carbon	89·16
Hydrogen	4.06
Oxygen	1·65
Nitrogen	1·21
Sulphur	1·39
Moisture	0·67
Ash	1·86
	100·00

"One pound of this coal is capable of evaporating from 212° Fah., 14·74lb. of water, and 1lb. of reducing from the oxide of lead 34·74lb. of metallic lead.

"No. 4.—'Griff' Coal.

"This is a coal of a dull appearance, dense and hard, with a concoidal fracture, different from either of the other two coals.

"Density of coal, 1,341; water, 1,000.

"The analysis in 100 parts.

Carbon	66·21
Hydrogen	4·09
Oxygen	11·07
Nitrogen	1·13
Sulphur	1·01
Moisture	9·23
Ash	7·26
	100·00

"One pound of this coal is capable of evaporating from 212° Fahr. 9·8 lb. of water, and 1 lb. of reducing from the oxide 25·14lb. of metallic lead.

"TABLE OF FOREGOING RESULTS:—

	No. 1. Ramsay's Coking Coal.	No. 2. Coke from Ramsay's Coking Coal.	No. 3. Llanguathog Merthyr Coal.	No. 4. Griff Coal.
Density	1·279	1·055	1·333	1·311
Carbon	85·57	86·91	89·16	66·21
Hydrogen	5·68	1·32	4·06	4·09
Oxygen	3·07	0·10	1·65	11·07
Nitrogen	1·48	0·80	1·21	1·13
Sulphur	1·46	1·94	1·39	1·01
Moisture	0·74	1·28	0·67	9·23
Ash	2·00	7·65	1·86	7·26
	100·00	100·00	100·00	100·00
Pounds of Water which 1 lb. of Fuel would evaporate from 212° Fahr.	15·18	12·78	14·74	9·8
Pounds of Lead reduced by 1 lb. of Fuel	34·99	31·35	34·74	25·14

"In glancing at the above table, the first thing that arrests the attention is the proportion of sulphur being greater in the coke than in the coal from which it was made, and by nearly half a per cent.

"It appears from my analysis that, although in coking coal there may be a notable loss, in the per centage of carbon, hydrogen, oxygen, and nitrogen, in the coke, yet the sulphur has not only not decreased, but has actually increased in the per centage. I find in the coking oven that not more than one-twelfth of the sulphur goes off from the coal, whilst the loss of the other gases is upwards of one-third of the whole.

"But portions of the coke may be found to contain a very much larger quantity of sulphur than I found in the above specimen, and if I had selected a piece from near the top of the column, instead of taking an average of the whole, I should have found very much more than I did.

"The pieces of coke delivered to me by your assistant, which he told me he had taken from a quantity from the tender of an engine in going down to Southampton, on the 2nd ultimo, gave on an average 5·62 per cent. of sulphur, and some which I selected myself from the coke-heap at the Nine Elms station gave about 5 per cent.

"The next peculiarity to be noticed between the coke and the coal from which it is made is, in the amount of ash being very much higher in the former than in the latter; this is caused by an excess of iron and silica principally, and were it not for the increase of ash there would not be so very much difference in their heating power, &c. I can only account for this increase in these two substances from their being volatilised in the coking-ovens, and entering into the crevices of the fuel from which the gases escape.

"It is common to find large quantities of a hair-like substance adhering to the coke, varying in colour from a light-grey to black; this is silica, with a trace of carbon and iron, and which has been in a state of volatilisation till arrested by coming to a cooler part of the coking-oven, where it has condensed, and is found as I have described it.

"NO. 3.—LLANGUATHOG MERTHYR COAL,

you will observe, is a coal of a very superior quality, and is nearly equal to Ramsay's coking coal in heating power, and has a very little less per centage of sulphur; but No 4, 'Griff' coal, though containing less sulphur than either, does not possess such heating power, which is partly owing to its containing a large per centage of water; this water is expelled when the coal is reduced to a fine powder, and submitted for some time to a temperature of 212° Fahr. The moisture in the other specimens was determined in a similar manner.

"I may state that my experiments were repeated, and great care was bestowed to verify any results which appeared contrary to what should have been expected, such as the larger amount of ash in coke, in comparison to the coal from which it was made, and the larger amount of sulphur in coke than in coal, the general belief being that in the coking of coal most of the sulphur is driven off."

I will now proceed to give a detailed statement as to my mode of procedure to ascertain the quantity of fuel consumed per trip from the Waterloo Station, London, to Southampton and back again, inclusive of the quantity used in getting up steam in the morning, and whilst waiting at Southampton. I personally inspected the weighing of the fuel in the morning, and again at Southampton, and on the return of the engine to Nine Elms I took an account of the coal which remained on the tender, and I had the fire-box cleared out, the hot material cooled and riddled, and the worthless portion separated, and I allowed the value in good coal for the remainder.

I commenced my experimental trips with the coal engine "Ironsides," which had been constructed on Mr, Beattie's patented plans, for burning coal only, and heating the feed-water, and took the 10.15 A.M. mail train from Waterloo to Southampton, and arrived there at 1.5 P.M. We commenced the return journey at 3.0 P.M., and arrived at the Waterloo Station at 5.58 P.M., the engine having performed the trip in the most satisfactory manner, and without any appearance of smoke, except when the steam had to be got up in the morning, or the fires prepared for the return journey.

The result of that day's trip will be seen by referring to the tabulated summary opposite November 15th, where the average consumption of fuel is shown as 16·71lbs. of coal per mile, or when reduced to its coke value equal to 11·14lbs. per mile, with an average load of 12·2 carriages per mile, travelling at an average speed of 31·25 miles per hour.

I have said that the consumption of coal, when reduced to its coke value, was equal to 11·14lbs. per mile; in explanation of my meaning, I beg to state experience has proved that, in order to make one ton of good coke suitable for locomotive engines, 1½ ton of the best coking coal is required, and with some kinds of coking coal, 1½ to 1¾ ton are necessary to produce one ton of coke. It will be evident then, that if the same load can be taken, at the same velocity and under the same circumstances in respect to weather, with equal weights of fuel, say with coal in engines fitted up with Mr. Beattie's patented contrivance, and with coke in the ordinary class of engines, a net saving is effected of one-third, or 33 per cent., in fuel alone, without taking into consideration the incidental saving consequent on the construction of coke ovens, the interest on capital, the cost of their maintenance, and the wages of workmen employed in the manufacture of coke.

From the tabulated summary, it will be seen that I worked the coal engine "Ironsides" for three days with little variation in respect to the quantity of fuel consumed, that little variation arising from the change in the weather. I then selected the coke-burning engine "Vesuvius," one of the ordinary class, and being nearest in dimensions and weight to the "Ironsides," and in good working order, and with it I took a similar train (10.15) to and from Southampton, burning coke only, and I adopted the same course of proceeding as on the former trips, but with a very different result as regards the consumption of fuel; for, on referring to the general summary, it will be seen that the average load was 12·1 carriages, the average speed 30·27 miles per hour, while the average consumption of fuel was 20·62lbs. of coke per mile. On the following day I took the "Express" train with the same engine, but the results were substantially the same as on the previous day with the "mail" train.

Having tried the "Vesuvius," I decided upon taking another coke-burning engine (the "Frome,") which was a similar class engine to the "Vesuvius," in order to ascertain if their was any difference in the results of their working. On referring to the summary of the trip opposite November 22nd, it will be seen that the consumption of fuel was remarkably near that of the "Vesuvius."

I then determined to test the capabilities of another coal-burning engine, the "Canute," and compare the results of its working the "express" train with that of the "Vesuvius." The load was lighter, averaging 9·3 carriages, but the average speed attained was higher, being 36·76 miles per hour. The consumption of fuel was 16·71 lbs. of coal per mile, the coke value of which is 11·14 lbs. per mile against 20·62 lbs. per mile consumed by the "Vesuvius."

The experiments up to this period showed a decided advantage in the coal-burning engines, so far as regarded economy of fuel, &c., but the results were not conclusive to my mind, inasmuch as the engines had not worked under precisely the same circumstances with respect to weather and uniformity of load and speed. I therefore obtained a sufficient number of carriages to form two trains of equal size and weight, and I had a quantity of materials weighed and placed in each of them equivalent to a load of passengers. The coal-burning engine "Canute" was attached to one of the trains, and the coke-burning engine "Vesuvius" to the other. The weight of the train, including engine and tender, drawn by "Canute," was 170 tons, 8 cwt., and that drawn by "Vesuvius," 167 tons 12 cwt.

The trains left London and Southampton within a few minutes of each other, so that there could be no difference between them in respect to weather, but lest either train should run heavier than the other from extra friction in the axle bearings, I took a second trip on the following day with the engines changed from one train to the other. I registered the particulars of each day's trip separately, but taking the average of the two days' working, the difference in respect to consumption of fuel will be more readily seen.

	Average speed.	Average consumption of fuel in lbs. per mile.	Load.
"Canute"	28·40	Coal 20·36	19 carriages.
"Vesuvius"	27·23	Coke 24·37	19 "

Coal reduced to its coke value 13·57, which shows a clear saving of 10·80lbs. per mile.

I subsequently tested the capabilities of the coal-burning engine "Canute" for making sufficient steam when drawing heavy loads, and as this engine was rather heavier than the coke-burning engine "Vesuvius," I obtained an additional number of carriages, and after they had been weighted I had twenty-eight of them attached to the "Canute," and twenty-two to the "Vesuvius," making the total weight of the "Canute" train 235 tons 13 cwt., and that of the "Vesuvius" train 189 tons 6 cwt. I was very desirous of testing the capabilities of the coal engine "Canute" for drawing a heavy load up the incline from Southampton to Andover (a distance of 22 miles) without the aid of a pilot engine, and for that purpose I added about 20 tons extra weight to its train beyond its proportionate load.

Early in the morning of December 19th, 1855, we proceeded to Southampton with the two trains, but unfortunately the water pipe attached to the lower part of the boiler in the "Canute" engine gave way, and the leakage therefrom became so great soon after we left Southampton that we were obliged to pump into the boiler an extra supply of water to compensate for the loss sustained. A reference to the registered account of the trip on that day will show that while the "Vesuvius" (coke) engine evaporated 7·13 lbs. of water by 1 lb. of fuel, the "Canute" (coal) engine evaporated 9·05 lbs. of water by 1 lb. of fuel. The amount of water, therefore, which passed from the tender of the "Canute" engine was greater by 1·92 or nearly 2 lbs. of water per 1 lb. of fuel than that from the tender of the "Vesuvius," but notwithstanding that mishap, the "Canute" generated sufficient steam to draw the 28 loaded carriages up the incline without any aid whatever.

The firing from the same cause was increased, but the result on the day's work of the two engines was still in favour of the coal-burning engine, as will be seen from the summary, and it is worthy of remark that when the coal is reduced to its coke value, the result is 10·30 lbs. per mile in favour of the coal burning engine "Canute."

I have shown that the saving effected by the coal-burning engines with the ordinary trains was equal on the average to 8·56 lbs. of coke per mile, or 10·80 lbs. of coke per mile when each engine worked under the same circumstances as to weather, &c., with equal loads; now, if the former quantity, viz., 8·56 lbs. per mile be taken, the saving is equal to 1·348 lbs. on each trip, or at the rate of 187¾ tons per engine per annum, at six days work in each week; but if the latter quantity, viz., 10·80 lbs. per mile be taken, the saving is equal to 1·721 lbs. at each trip, or 239½ tons per engine per annum.

The consumption of coke by the coke-burning engine "Vesuvius" during one of the trips referred to was 29½ cwt., which, at 31s. 6d. per ton, was equal to £2 6s. 6d., whereas the consumption of coal-burning engine "Ironsides" during another of the trips was 24¾ cwt., which, at 19s. per ton, was equal to £1 3s. 6d., giving a clear saving on the latter per trip of £1 3s. In my report to the Directors of the London and South Western Railway Company, I stated that if they had seventy engines in steam per day, and each of them was fitted up for burning coal, and all worked under similar circumstances to the "Ironsides," there would be a daily saving to the company of £80 10s., or £483 per week of six days, or £25,116 per annum.

From the result of these interesting and important experiments I trust I have succeeded in demonstrating the truth of the assertions I made at the meeting to which I have referred, namely, that coal can be used more economically in locomotive engines than coke; that by the use of coal sufficient steam can be generated to supply locomotive engines when working at high velocities and when drawing heavy loads; and, in support of my assertion relating to the capability of coal-burning engines, built in accordance with Mr. Beattie's patent, consuming their own smoke, I have to observe that a goodly number of them are at work on different lines of railway, and testimonials of their efficiency have very frequently been given.

There yet remains the question of the durability of the fire boxes and tubes when coal is used instead of coke, and I do not think that I could offer a better proof of the superiority of coal over coke in this respect also, than by quoting a portion of a report which I made on this important subject on the 26th of May, 1858, to the Locomotive Superintendent of the Manchester, Sheffield, and Lincolnshire Railway. The engines there referred to were built in accordance with Mr. Beattie's patent for burning coal and coke:—

"With respect to the durability of the tubes and fire-boxes, when coal is used instead of coke, I consider that question to be settled beyond dispute in favour of the former, inasmuch as it no longer remains a matter of opinion merely, but the result of continuous working with coal and coke demonstrates beyond all doubt that not only is coal superior to coke in respect to heating power, and consequently decidedly more econonomical, but it is less injurious to both the tubes and fire-boxes of locomotive engines; as a proof of this I beg to append a copy of a tabular statement which I had the honour of laying before the directors of the London and South Western Railway in the month of March, 1856, showing the average duration of a set of tubes in their locomotive engines when coke alone was used. At that time as well as in the latter part of 1855, after I had made a series of experiments with coke and coal, I came to the conclusion that the tubes and fire-boxes would sustain less injury by the use of coal than coke, and although one of their coal engines had then run but 51,300 miles and no really appreciable depreciation had taken place in either fire-box or tubes, I saw sufficient to warrant me in concluding that the life of a set of tubes, as well as that of the fire-box, would be considerably prolonged by the use of coal instead of coke. Time has proved that the opinion I then formed was a correct one, inasmuch as I have, up to the present moment, carefully watched the effects produced on the fire-boxes and tubes of the locomotive engines on the London and South-Western Railway; and taking two of their engines which I have examined, where even part coke and part coal have been used up to the commencement of the present month, you will perceive the amazing difference in favour of coal when you compare the results with the tabulated statement copied from my printed Report, dated March 25th, 1856.

MILES RUN BY THE UNDERMENTIONED COKE ENGINES, WITH ONE SET OF TUBES, ON THE LONDON AND SOUTH-WESTERN RAILWAY.

Working Pressure of Steam.	Name of Engine.	Miles run.
100 pounds	Volcano	118,978
100 ,, ...	Stromboli ...	127,855
100 ,, ...	Vulcan.........	128,947
100 ,, ...	Milo...........	104,627
100 ,, ...	Etna	105,985
90 ,, ...	Ruby	101,905
90 ,, ...	Serpent	92,048
80 ,, ...	Medusa	106,590
100 ,, ...	Windsor	99,907
100 ,, ...	Mercury	73,100
80 ,, ...	Fire King ...	102,258
80 ,, ...	Mazeppa	89,059
100 ,, ...	Sussex	99,624
100 ,, ...	Mars...........	103,257
100 ,, ...	Comet.........	97,201
80 ,, ...	Hawk	74,955
80 ,, ...	Acheron	87,759
100 ,, ...	Test...........	76,182
100 ,, ...	Stour	69,688
100 ,, ...	Rocklia	86,469
100 ,, ...	Avon	78,785
100 ,, ...	Trent	65,634
100 ,, ...	Frome	83,108

Average duration of tubes, 94,518 miles.

"From the above table you will perceive the average duration of a set of tubes was 94,518, whilst in the two engines I have referred to, where coal and coke have been used, one of them has run 154,955 miles, and is now carrying 120 pounds pressure of steam, none of the tubes having failed, and they are still in good working condition, and I am unable to say how much longer they will last. The other engine has run 137,676 miles, and I have had two of her tubes sent to my office in Queen's Chambers, Manchester, which you can see at any time.

"I personally paid a visit to the works at Nine Elms and examined these engines; and, bear in mind, that although a portion of the fuel used in these engines is coke, yet the tubes I now refer to have only worn to the extent of three wire guages in thickness; they were ordered and made to No. 13 wire gauge, and are now No. 16 wire gauge.

"No doubt exists in my mind that the principal portion of this amount of reduction in thickness is attributable to the cutting action of the coke, and not to the effect of any deterioration produced by the action of the coal. With regard to the effect on the fire-box of the latter engine, the back, sides, and crown, are $\frac{1}{32}$ of an inch less than their original thickness, namely, $\frac{1}{2}$ an inch; the tube-plate has been reduced $\frac{1}{16}$ of an inch, the original thickness being $\frac{3}{4}$ of an inch. From these facts you will be able to draw your own conclusions—they speak for themselves—for in one case, where coke alone was used, you have an average (taken from the Company's books) of 94,518 miles as the life of a set of tubes, whilst in the other, where coke and coal are used on the same railway, and working similar trains, you have 154,955 miles run in the one case, and 137,676 miles in the other, and the tubes still in good working condition.

"I have given you these facts as a sample of the results when coke and coal are used, because the fuel you are using in your engines is of a similar character; but I am prepared to prove that were your engines constructed to burn coal alone, the fire-boxes and tubes would be protected from the cutting action of the coke, and greater durability, much beyond the mileage I have reported for coke and coal, would be the result. I am not ignorant respecting the argument that some persons have advanced as to coal containing a greater amount of sulphur than coke; this is a fallacy which I have had proved beyond doubt, and therefore I hesitate not to give you a strong opinion in favour of coal, for instead of its proving destructive to fire-boxes, tubes, or smoke-boxes, the result of my observations and experiments proves the contrary."

In further confirmation of the increased durability of the tubes, I beg to state that the mileage of another engine of the same class as the two referred to, and burning a mixture of coke and coal amounts to 181,589 miles, and the tubes are still in good condition, and working at a pressure of 120 pounds to the square inch.

In conclusion I beg to remark, that previously to the year 1853, several attempts had been made by different individuals to introduce coal as a substitute for coke in locomotive engines, but from various causes they did not persevere in developing its true commercial value, and I would take this opportunity of stating that the credit of this important saving in railway expenditure is due to the skill and persevering industry of Mr. Joseph Beattie.

SUMMARY OF EXPERIMENTAL TRIPS MADE ON THE LONDON AND SOUTH WESTERN RAILWAY.

DATE.	Name of Engine.	Description.	Average Time in Hours and Minutes	Average Speed in Miles per Hour.	Average Feet Consumed in lbs. per Mile.	Coal Reduced to its Coke Value.	Quantity of Water Evaporated per Mile in lbs. for 1 lb. of Fuel	Highest Temperature of Water in Tender during each Trip.	Lead in Number of Carriages.	Weight of Train including Engine and Tender.		REMARKS.
1855.										Tons	Cwts.	
Nov. 15.	Ironsides .	Coal.	2·31	31·25	16·71	11·14	8·29	124°	12·2	...		Beautiful, clear, frosty day and calm.
,, 16.	Ditto	Coal.	2·31	30·68	17·24	11·49	6·72	158°	10·6	...		Damp foggy day, rails greasy for 50 miles.
,, 17.	Ditto	Coal.	2·39	29·71	19·02	12·68	7·07	164°	12·1	...		Clear day, with strong side wind in favour of down and against up journey.
,, 19.	Vesuvius .	Coke.	2·36	30·27	20·62	...	7·15	76°	12·1	...		Wet drizzling rain, with light wind on our back.
,, 20.	Ditto	Coke.	2·26	35·23	20·62	...	7·78	74°	12·2	...		Rails rather greasy; wind against down journey.
,, 22.	Frome ..	Coke.	2·27	32·14	20·97	...	7·62	94°	13·3	...		Ditto ditto ditto.
,, 23.	Canute ...	Coal.	2·11	36·76	16·71	11·14	7·35	166°	9·3	...		Fine clear day, with light wind in favour of down journey.
,, 30.	Ditto	Coal.	2·49	27·65	20·51	13·67	8·26	142°	19·0	170	8	Fine frosty day; rails greasy for first 50 miles.
,, 30.	Vesuvius .	Coke.	2·56	26·54	23·82	...	8·21	54°	19·0	167	12	This was the first trip with equal loads.
Dec. 1.	Canute ..	Coal.	2·39	29·16	20·22	13·48	8·07	180°	19·0	170	8	Great difficulty in starting. Rails slippery in consequence of frost and damp fog; wind rather stiff against us.
,, 1.	Vesuvius .	Coke.	2·47	27·92	24·92	...	7·78	54°	19·0	167	12	
,, 19.	Canute ...	Coal.	2·55	26·92	29·80	19·86	9·05	...	28·0	235	13	Frosty, with strong head wind against us.
,, 19.	Vesuvius .	Coke.	3·09	24·71	30·16	...	7·13	36°	22·0	189	6	Water pipe in Canute gave way. Shut off heating apparatus.

DISCUSSION.

The Secretary read the following communication, received from

Mr. D. K. **Clarke**, who says—I perfectly agree with Mr. Fothergill in assigning to Mr. Beattie the honourable position of pioneer in the successful practical introduction of coal as a substitute for coke in locomotive engines, as there can be no question that, by his persevering efforts, he first succeeded in fairly arousing public attention to the real magnitude and importance of the economy in working expenses in railways that might be effected by the general use of coal as fuel. I believe that from this source of economy alone an addition of nearly 1 per cent. may be made to the dividends on the original share capital of railways, taking one with the other, with the reduced tear and wear of locomotives so ably pointed out by Mr. Fothergill. I think, however, that the mode adopted in the paper, of illustrating the saving in cost effected by the substitution of coal for coke is open to criticism, and does not place the question on its proper basis. It is true that the quantity of coke manufactured from a given weight of coal weighs only two-thirds of the original coal so consumed, and that 1½ ton of coking coal make only one ton of coke. But in seeking to establish this ratio of three to 2 as the measure of saving, that is, that the cost of fuel is reduced one-third in dispensing with the coking process, it is overlooked that coking coal, as coal, is not the proper fuel for locomotives, and that therefore the calculation of saving should be based, not upon the relative quantities of coking coal and of coke made from it, but upon the relative prices and efficiency of proper locomotive-coal and coke. This ratio is necessarily very variable, as it is affected by cost of transport and other elements. For instance, on one metropolitan line, whilst coking coal costs 12s. 6d. per ton, and the coke made from it costs 18s. 6d., other coal, suitable for locomotive uses, costs as much as 15s. per ton. On another line, whilst the cost of coke is 23s. per ton, the coal suited for locomotives costs 20s. per ton, or only 13 per cent. less. Again, take the North Eastern Railway, at Newcastle, the difference of the cost of coke at from 8s. to 11s., and locomotive coal, at 7s. per ton, is so inconsiderable as to scarcely make it worth while to use coal on that line. Notwithstanding such local approximations in cost, there can be no doubt of the economical importance of the question before the meeting. Again, in the comparison of the coal-burning engines with the coke-burning engines of the South-Western Railway, no allowance has been made for the benefit of heating the feed-water in the former, as against the use of cold water in the latter; whereas my own experience with Mr. Beattie's engine, the Canute, showed a most material increase in the consumption of coal when the feed-water was not heated. The following were the results I obtained from the engine with hot and cold water respectively:—

	Average train.		Coal consumed per mile.		Temperature of feed-water.
With heated water	11	carriages	17·4 lbs.	...	191 deg.
With cold water...	11	ditto	24·0 lbs.	...	56 deg.

Showing an increase of 6·6 lbs. of coal per mile, by using the feed-water cold, as was done in the coke-burning trials recorded by Mr. Fothergill. The coke value would therefore be 16 lbs. per mile, and not 11 or 12 lbs., as assumed in the paper, for comparison with the coke-burning engines. The large extra consumption of coal, by shutting off the heating apparatus, is no doubt greater in proportion than would be deducible from the known constituent heat of steam and water; but it is caused also by the less favourable working conditions of the engine involved in the use of cold water. I hope, on another occasion, to bring the results of my own practice in coal-burning without smoke before the Society.

The **Chairman** said the paper they had heard was a very interesting one, and reduced itself to this:—Mr. Fothergill proposed to establish that which appeared to be a very simple proposition, namely, that the whole was greater than its part; in other words, that coal which contained all the elements of combustion and locomotive power was more effectual than the same coal when deprived of some of its elements and converted into coke. It was a most important subject, not only to railway companies, but also to the public at large, who must derive great advantages from the enormous saving in the expenditure for fuel, which Mr. Fothergill had pointed out, and his arguments appeared to have great plausibility. He (the Chairman) would now be happy to hear the opinions of gentlemen present, whom he knew to be well acquainted with the subject.

Mr. **Grantham** had listened with great pleasure to Mr. Fothergill's paper, as treating of a subject of very great importance, not only in a scientific point of view, but also as affecting the dividends upon railway property. He must confess that his friend's paper had a little disappointed him upon one or two points, and if it should be agreed that some matters of importance had been omitted, he would call upon the Society to award a gentle punishment to Mr. Fothergill, by asking him to read a further paper upon the same subject. He would, in the first place, call Mr. Fothergill's attention to what he considered an important omission in his paper, he not having stated whether he employed the hot water apparatus in the coke-burning engines, as well as in those burning coal. Perhaps Mr. Fothergill would be good enough to enlighten them upon that subject. He would also ask him whether he had considered the question of the blast in the coke and coal burning engines, as he was of opinion that a much greater heat would be found in the smoke boxes of the latter than of the former, and less blast would therefore be required. That was an important point. Mr. Fothergill had stated that the wear and tear of the tubes of the boiler was very much less in the coal than in the coke-burning engines. That fully corresponded with his own experience; but there was another element to be considered, viz., the first cost of this particular description of engine. There might be a question whether the first cost of the engine, which appeared to be an expensive one, did more than make up for the difference in the wear and tear under the two systems. He did not say this with a view to depreciate the statements made in the paper, for he was an ardent admirer of the use of coal in locomotives. There was also another very important question—viz., the heat of the gases in the smoke box. He was afraid that railway engineers had overlooked this too much, and he feared also that those who had made experiments upon the subject had made some mistakes. He had lately taken pains to make inquiries of some of the leading engineers as to the heat in the smoke boxes of locomotives, and the answer he got generally was, that experiments had been tried, and that the temperature had been reduced as low as 300 deg. of heat; others had informed him that it was about 400 deg. of heat in the smoke box. A curious experiment had been tried in his own neighbourhood, where a thermometer had been let down into the smoke box, the bulb of the mercury going into the box for some distance, and the scale being in sight of the engineer. When the engine was standing at the station the thermometer recorded 300 degrees, but it had no sooner started than the thermometer fell to 150 degrees. This gave rise to some speculation as to the cause of this wonderful phenomenon, and many theories would, perhaps, have been founded upon it, but the whole was easily explained by the fact that round the thermometer there was a space, so that when the engine was put in motion, and the blast came into operation, the cold air struck upon the bulb of the thermometer, and lowered the temperature of the mercury. He believed the temperature of the fire-box would be much affected by the use of coal, and he was sorry that Mr. Fothergill had not brought that subject forward as an element in his experiments. Within the last few weeks he had been called upon to try some experiments upon locomotive engines in connexion with a subject which he was happy to see illustrated by some specimens upon the table that evening, which he hoped would come before the the Society at a future time in a more connected form. Referring to these specimens of spiral heat-diffusers, Mr. Grantham went on to explain that the glass tubes shown, represented the tubes of a boiler, and contained a spiral bar of metal. This was the invention in the first instance of Mr. Duncan, a gentleman of considerable scientific attainments, who took out a special patent for it. Their mutual friend, Mr. Charles Wye Williams, whose name was honourably known to the Society, without being aware of these experiments, was making others in the most accurate manner of his own upon the same subject, and on an extensive scale. Mr. Wye Williams's apparatus was also the subject of a patent; and as these patents clashed with each other, and there were points in each which the other party thought desirable to be retained, they amalgamated their interest, and the invention was now known under the designation of Duncan, Gwynne, and C. Wye Williams's heat diffusers. Mr. Grantham proceeded to detail the results of experiments made with the heat diffusers as recorded by Gauntlett's pyrometer. The diffusers were placed in the tubes of the boiler, and he knew from experiment that they reduced the heat in the smoke box prodigiously, probably 200 or 400 degrees. The indication of the pyrometer with the heat diffusers in was 800 deg. in the smoke box, and he believed it would have risen to 1,000 or 1,200 deg. if the heat diffusers had not been in use. He had every reason to suppose that if coke had been used in the engine instead of coal, the heat in the smoke box would have been less. If, therefore, Mr. Beattie's or any other coal-burning engine had this enormous temperature in the smoke box, it was evident that there was room for improvement in that respect, and it was another item in favour of coal if these deductions were correct. He would state in passing that the heat diffusers above alluded to promised very good results, the first trials showing nearly 20 per cent of gain, and one of the practical difficulties in using them, viz., the supposed tendency in the tubes to become closed with ashes, had not taken place. Looking at the title of the paper, he regretted that Mr. Fothergill had confined his observations to one system only, as he was aware that he had an abundant store of information upon the burning of coal under other circumstances. He did not say this to detract in any way from the merits of Mr. Beattie's improvements. That gentleman had courageously faced the question, and was the first to direct public attention to it. He (Mr. Grantham) had, however, great hopes that some simpler means than those introduced by Mr. Beattie would be adopted. For a great many years he (Mr. Grantham) had attended the experiments of Mr. Wye Williams, and had been a party to most of the investigations made by that gentleman upon the combustion of coal, and from the experience thus derived, he was of opinion that the operations so necessary in this matter would be carried on by a simpler engine than that of Mr. Beattie—combining, it might be, many of his contrivances, but doing away with a great deal that was complex.

Mr. JOHN BRAITHWAITE, having been called upon by the Chairman, said that having the intention at some future time to bring forward some views of his own in reference to combustion, he must decline entering fully upon the subject that evening. He had listened with attention to the remarks of the last speaker, and there were several of his views which, in the paper that he hoped to be allowed to bring before the Society at a future period, he should endeavour to controvert. Whether it was a question of using coal or coke, he believed the present arrangement of furnaces and the manner of producing combustion were very far behind what he hoped would ultimately be arrived at. He thought that, ere long, the boilers of engines would be constructed of a different form, so as to produce more efficiently the draft in the furnace, not precisely after the plan which he (Mr. Braithwaite) brought forward in 1829, but such an improvement upon it that the combustion would be steadily carried on, and the gases essential to the generation of steam would be given out without the use of the diffuser to which allusion had been made. This principle had been carried out in the caloric engine, and had been found, so far, successful.

The CHAIRMAN was gratified to hear that it was Mr. Braithwaite's desire to give them the benefits of his practical experience in these matters.

Mr. BRAITHWAITE would be glad to do so, and for that reason he would not then forestall anything he had to say.

Mr. JOHN BETHELL being called upon by the chairman, said he did not feel himself competent to say much upon this point, because the paper was chiefly directed to locomotive engines, of which he had had little or no experience. He might, however, make an observation with reference to the general question as to the comparative merits of coal and coke. He confessed he did not think the paper had sufficiently entered into it. Some years ago it was stated at the scientific institutions, that the coke made from a certain quantity of coal would give the same amount of heat, and evaporate just as much water, as the coal from which it was made. He believed that was a theory which was advocated in that room some years ago, by his friend, Mr. George Lowe. He (Mr. Bethell) confessed he was astonished at that theory, for when they observed the great heat that was generated in converting coal into coke, it seemed very remarkable that the coke should, after being subjected to that process, give as much heat as the coal itself. He had burned many thousand tons of fuel in the stationary engines of his manufactories, and after some consideration of the subject it was clear to him that the difference arose entirely in the mode of burning the fuel. It was possible, no doubt, to construct a furnace which would give coal no advantage over coke. The real point was, the proper construction of the furnace. It was excessively simple to burn coke when operated upon by a strong draft, so as to get all the heat out of the carbon which it contained; but it was not so simple to burn coal, because this involved two operations; they had to burn the gases, which required one mode of treatment, and the carbon, or coke, which required another mode of treatment. He confessed he had not yet seen any plan which, in his opinion, was perfect for carrying out his ideas of burning all the gas and all the carbon. The plan laid before them that evening appeared to him very complicated. In France and Belgium, where they burnt a great deal of coal, as well as a patented fuel which contained more gas than coal, they had a simple apparatus for doing it, and they carried out the process in the locomotive engines without producing so much smoke as he had met with on railways in this country. He would not then describe it in detail, but it was a simple arrangement of the fire-box, which allowed air to pass in over the fire. He had hoped the paper would have gone more into the general question, and not have been confined to one description of locomotive. There were many locomotives as well as fixed boilers working in this country, in which various plans were adopted, by which the gas from coal was more or less burnt, though not always efficiently. With regard to the analyses before them, he confessed he was astonished at them, and he could hardly believe them to be correct. It was easy to take an analysis of the composition of coal, but the ascertaining how much water a certain fuel would evaporate was a different matter, as apparatus specially adapted to the different kinds of fuel was necessary in order to obtain reliable results. If they were using an apparatus to burn coal which contained the gases as well as the carbon, they must have an apparatus in which the air came over the fire, and if the same apparatus was used for burning coke it would not answer. Hence they found it stated in the table before them that 1lb. of Ramsay's coal evaporated 15lbs. of water, whereas 1lb. of coke evaporated only 12 lbs. of water. He believed if the coke were used with a proper apparatus it would evaporate more. Again, they found it stated that the Merthyr coal, which contained 89 per cent. of carbon and 4 per cent. of hydrogen, or 93 per cent. of heat-giving properties, evaporated only 14 lbs. of water per lb. of coal, whilst Ramsay's coal, which contained only 90 per cent. of heat-giving properties, evaporated 15 lbs. of water. That, to a theoretical man seemed an absurdity, and showed that in all experiments as to using fuel for the evaporation of water, everything depended upon the manner in which the fuel was used. The Welsh coalowners had, for a long time, contended that their coal would evaporate a larger quantity of water than the Newcastle coal; latterly, however, the Newcastle gentlemen had asserted that their coal would evaporate more water than the Welsh coal; but, to his mind, such statements ought to have no weight, unless each description of coal was used with an apparatus especially suited for it. Then came the question, whether the apparatus which was suitable for any particular description of coal could be practically adapted for general use with steam boilers. That was a matter which they all knew to be one of considerable difficulty. They could easily construct a small experimental apparatus, but they might not be able to apply it, when coal was burnt in masses for heating large boilers. He did not think the meeting was in a condition to argue this question upon the data given in the paper before them, or to enter into it in a way that its great importance deserved.

Mr. GEORGE LOWE, F.R.S., said, although he was not a locomotive engineer, yet he had been connected with the combustion of coal and coke in London for the last thirty years. He agreed with Mr. Bethell that there were anomalies in the tables before them, which were most perplexing. Some of those anomalies had been already referred to, and in one instance it was evident that there was some mistake, viz., in the statement that there was more sulphur in coke after it had undergone the carbonising process than in the coal itself. As gas men they knew that when the gas was evolved from the coal a certain amount of lime was wanted to get rid of the sulphur which came out of coal during the process; and therefore he thought there must be some error in the analyses before them. The point, however, to which he most desired to address himself was with reference to a statement which Mr. Bethell had noticed as having been made by him (Mr. Lowe) on the occasion of the reading of a paper upon this subject by Mr. Apsley Pellatt when he had the honour of occupying the chair. On that occasion he begged to state he gave the general opinions of the books—of the schools—rather than his own. They all looked up to Mr. Apsley Pellatt as a tolerably good chemist and a close reasoner, and that gentleman's experiments upon the relative value of coal and coke for the purposes of his immense manufactory had been of the most beautiful and satisfactory kind. Mr. Apsley Pellatt would work one week or a fortnight with coal and the next with coke made from the same amount of coal, and he had shown that in every instance the work in his manufactory was done as well with the coke produced from a ton of coal as with the coal itself. There were eminent French chemists who confirmed Mr. Pellatt's views, which were further confirmed by some experiments made at Philadelphia; and it was to be remarked that whilst Mr. Apsley Pellatt was working upon a large scale, the French chemists on a small scale in a laboratory, and the Americans on another scale, and he (Mr. Lowe) was also making his own experiments, the results of all these trials seemed entirely to coincide. He would now say a word or two upon the best mode of conducting the combustion both of coal and coke. The English locomotive had done great credit to the skill of our engineers, as was proved by the fact that as much as 10lbs. of water was evaporated with 1lb. of coal; and there was every hope that much higher results would eventually be obtained. Some of the experiments recorded by Mr. Fothergill were made as far back as 1855; but the French engineers, during the last two years, had made immense progress in the successful introduction of coal into the locomotive engine. After all, the great thing was how to conduct the combustion so as to make use of all the heat-giving properties contained in 1 lb. of coal. Mr. Bethell had, no doubt, hit the point in stating, that it was absolutely necessary that a certain amount of air should go over the fire, as well as through the furnace to produce the proper combustion of coal. Very little air was wanted to go over the furnace if they used coke, but if they used coal, then a certain amount of atmospheric air must go over the furnace so as to combine with, and promote the combustion of the hydro-carbons and other inflammable matters, which, if they got so far as the chimney, went off in smoke and were lost. The great object was to prevent smoke and produce heat. Many years ago his (Mr. Lowe's) father conducted one of the largest malting establishments in the country, and the whole of the heat in the kilns was produced by the bituminous coal of Derbyshire. All the products of combustion went through the kiln, and if any smoke had been produced, five minutes would have sufficed to destroy a very large quantity of malt. For the last thirty-five years there had not been a furnace erected by him, in any part of the world, from Lima to Calcutta, in which the principle of letting a certain amount of atmospheric air pass over the surface had not been adopted. Mr. Lowe directed attention to a model of a furnace designed by him, in 1828, which had remained in Berlin for many years, and in which this principle was shown. He concluded by expressing a hope that Mr. Fothergill would, at some future time, favour them with a further paper upon this important subject.

Professor JOHN WILSON, F.R.S.E., would refer to the comments of Mr. Bethell, in which that gentleman challenged the correctness of the analyses given in Mr. Fothergill's tables. He apprehended that Mr. Bethell imagined these to be practical results, but he (Professor Wilson) believed them to be merely theoretical calculations, based upon the possible evaporating power of coal depending on the quantity of carbon and hydrogen it contained. In No. 1 of the table, the amount of carbon and hydrogen contained in the coal was 90 per cent., and in No. 3 the amount of those elements was 93 per cent., and yet the combustion of the latter gave a smaller amount of evaporating power than the lesser proportion of carbon and hydrogen in No. 1. If Mr. Bethell would bear in mind the vast difference between the power of hydrogen and the power of carbon to generate heat, he would readily be able to reconcile the difference in the results obtained in the two cases, which depended on the atomic proportions in which these two substances combined with oxygen. He thought, therefore, the surplus of carbon in the second case would be more than sufficient to account for the difference between the quantity of water evaporated by the two qualities of coal respectively. This brought him to a point mentioned in Mr. Clarke's letter, in which that gentleman spoke of the difference between coal which was suitable for locomotive engines and that from which coke was made. He stated that the bituminous coals were not those best suited for these engines. If his (Professor Wilson's) idea was right, as to the value of fuel depending upon the amount of hydro-carbons it contained, then the more highly bituminous the coal was the greater would be its evaporative power. Therefore, if they burnt coal they ought to get that which contained the largest amount of bituminous matter, in preference to that from Wales known as steam coal. Having defended Mr. Fothergill's analyses so far, he would now begin to challenge them himself. There was one point which struck him as rather curious. He could reconcile the difference in the relative quantities of sulphur in coal and coke, for when, as had been stated, it took 1½ ton of coal to make a ton of coke, it was possible that an extra amount of sulphur might exist in the coke; but he could not understand how coal containing 2 per cent. of ash, could be converted into coke containing 7 per cent. of ash, when only 1½ parts of coal went to make one part of coke. He took great interest in the question of the introduction of coal into the locomotive engine, and he should hail any contrivance that would enable the locomotive to consume coal with the same amount of comfort to the public as they now had with coke.

Mr. BETHELL thought he might have been misunderstood in his remarks in reference to the experiments on the relative heating powers of coal and coke. The point he desired to lay stress upon was, that he could not understand, and he could not believe, that if proper apparatus had been used for burning the coke, the evaporative power would have been so small in comparison with that produced by coal.

Mr. CHARLES GREAVES, on being called upon by the Chairman, said he did not feel himself to be well informed upon the bearing of this question as to locomotives, and the paper being specially applied to locomotives, it was only in reference to the burning of fuel in that manner that it was open to much criticism. For his own part, in comparing the efficiency of coal and coke in stationary boilers, and with every contrivance for husbanding heat, he had found coke had produced greater efficiency than coal. He had tried every method for raising coal to the full efficiency of coke by weight, but he had not been able to do so by any process for the admission of atmospheric air. He had taken part in the discussion of Mr. Apsley Pellatt's previous paper about two years ago, and his further experience confirmed the opinion he then expressed, that the superiority of coke over coal by weight was from 12 to 14 per cent. In point of price, however, coke in London was 60 per cent. dearer than coal; there was, therefore, room for a considerably superiority in efficiency by weight of coke over coal, while still leaving a large economy in money in favour of the latter. There was one point about which he should like to hear a little more, that was as to the theory of the coke cutting the tubes of the boiler, for if that were the case what became of the coke? Did it go up the chimney and blow away as solid coke? This point had yet to be determined.

After some remarks from Mr. DUNCAN in reference to the analyses given in the paper,

Mr. FOTHERGILL, in reply upon the discussion, said he had been entirely misapprehended by one or two gentlemen in reference to the analyses he had given. These analyses had been made in the laboratory of Mr. Dugald Campbell, and were not the result of actual experiment from the use of the fuel in a locomotive engine. With regard to the statement of one or two of his friends that he had not brought the general subject fully before the meeting, he begged to state that these gentlemen had overlooked the object of this paper, which he had brought before the Society in fulfilment of a pledge he had given to communicate the results of experiments in which he was engaged as to the comparative merits of coal and coke as applied to the engine which was the invention of Mr. Beattie. That being the case, it would have been, he considered, quite out of place to have introduced more modern experiments in order to confirm the results obtained at that period. With regard to the question of heating the feed-water referred to by Mr. Clarke in his letter, he would state that when experiments were first made with Mr. Beattie's engine that contrivance was not appended to it. The apparatus then used did not enable them to feed the boiler with hot water at starting, but as they proceeded on the journey the temperature of the water became higher; but in the modern contrivance they could commence the journey with the feed water at a high temperature. With regard to the relative quantities of the fuel, he had stated that 1½ ton of coal had been used to produce 1 ton of coke; in some instances the quantity had been 1¾ ton of coal to produce 1 ton of coke; but in order that there might be no misunderstanding upon that point, he had put the calculation into the money shape, and he had stated what the result was without taking into consideration how much coal it required to produce a ton of coke, but had at once given the cost of working the train, which he thought was the legitimate question to which they should turn their attention. He took the coal furnished at a given price, and also the coke, and then instituted a comparison between the two, not troubling himself about the different classes of coal and coke. He had conducted experiments for the Lancashire and Yorkshire, and the East Lancashire Railway Companies, but there was not time to apply the contrivance for heating the feed-water. With regard to the blast-pipe in Mr. Beattie's engines, they had had to increase the amount of air to soften the blast, for if they had a powerful blast, they then got an over-heated smoke-box. He never knew an instance of that upon the South Western line but once, which was during a heavy wind, where they had a powerful blast, and the whole of the steam was used in passing up the chimney. The remainder of the questions discussed he believed had been satisfactorily answered in the paper itself, and he begged to thank the meeting for the attention with which they had listened to him.

The CHAIRMAN said they had heard a most interesting paper, and discussion upon it. After all that had been said on either side, they must come to the practical question—whether the use of coal or coke was the most economical, as well as the best mode of working a locomotive. He had not gathered that the accuracy of Mr. Fothergill's tables, in respect of the comparative economy of the two systems had been impugned. Experiments with the engines at the same speed, and for the same distances had been tried, and the result was as Mr. Fothergill had stated; and unless any one was prepared to impugn that statement, the case must be considered as so far made out. Mr. D. K. Clarke had made a most important statement. He had said that, supposing Mr. Fothergill's experiments to have been clearly made out, there would be a saving of one per cent. upon the aggregate railway dividends throughout the country, or no less than £300,000 per annum upon the railway capital of 300 millions. He thought the meeting was very much indebted to Mr. Fothergill for his simple, clear, and able statement of a very difficult and interesting question, and he hoped at some future period that gentleman would be induced to give them some further information upon the subject. He was sure the Society would unanimously pass a vote of thanks to Mr. Fothergill for his very interesting paper.

The vote of thanks having been passed,

The Secretary announced that on Wednesday evening next, the 25th inst., a Paper, "On the Application of Definite Proportions and the Conic Sections to Architecture, illustrated chiefly by the Obelisk, with some History of that Feature of Art," by Mr. John Bell, Sculptor, would be read.

UNIFORM MUSICAL DIAPASON.

The following is the article from the *Saturday Review*, alluded to in Mr. Harry Chester's letter on this subject in last week's *Journal*. (See page 453) :—

Very considerable inconvenience has long been felt in the musical world in consequence of the want of a uniform standard by which the pitch of musical instruments, whether used individually or in concert, might be regulated. The tendency in all the most celebrated orchestras to an increased elevation of pitch has been attended by evils which affect the interests of music in no small degree. Composers, instrument-makers, and artists are alike sufferers from this cause, and the great difference existing between the pitches (or diapasons, as they are called) of various countries, or of various musical establishments, is frequently a fertile source of embarrassment in musical transactions. With a view to remedy this acknowledged and growing evil, the French Government some time ago appointed a commission of distinguished men to discuss and collect information upon the whole question; and the result of their labours has lately appeared in the *Moniteur*, in the shape of a very elaborate and interesting report.*

The commission consisted of fourteen members, all of them eminent in the world of music or science, as the following enumeration of their names will show:—Pelletier (Secretary-General in the Ministry of State, President), Halévy, Auber, Berlioz, Despretz (Professor of Physics at the Faculty of Science), Camille Doucet (Ministerial Head of the Theatrical Department), Lissajous (Professor of Physics at the Lycée St. Louis, and Member of the Council of the Society for the Encouragement of Works of National Industry), General Mellinet (Superintendent of the Bands of the Army), Meyerbeer, Monnais (Imperial Commissary at the Lyrical Theatre, and at the Conservatoire), Rossini, and Ambroise Thomas. Any opinions emanating from a body of men so well qualified to judge upon a subject of this nature must necessarily be worthy of attention; and we think, therefore, that a short summary of their report may not be uninteresting to the musical portion of our readers.

The report commences by stating that it is an undoubted fact that the diapason, or pitch, has been steadily rising for at least a hundred years, and that it is now quite a whole tone higher than it was in the middle of the last century. As a proof of this, we have the internal evidence of the scores of Gluck, Monsigny, Grétry, and others, besides the more certain testimony of the organs of the time. Rousseau (*Dictionnaire de la Musique*, article *Ton*), states that the pitch of the opera in his time was lower than that of the chapel, and consequently more than a tone lower than that of the opera of the present day. The first question, then, that naturally presents itself for consideration is, what were the causes which have led to this result? Vocalists cannot fairly be charged with any participation in producing this change. They screamed, it seems, even in those days, without the facilities afforded to them by the operas of Signor Verdi. Besides, it is manifestly never for the interest of the singer that the diapason should be forced up—a circumstance which can only tend to increase his fatigue and make inroads upon his voice. The interests, too, of composers are, for many reasons, opposed to an undue elevation of the pitch. They have, moreover, but little power of influencing an orchestra in this respect. The composer does not fix the diapason—he submits to it. It is, then, says the report, to the instrumentalists and the instrument-makers that this result must be attributed. They are the persons who have evidently a joint interest in raising the diapason of the orchestra. Up to a certain point, the more elevated the pitch the greater the brilliancy and sonority of an instrument.

The numerous inventions and improvements which have been effected in wind-instruments have more than anything induced the unnatural height which the diapason has now reached. A direct confirmation of this is afforded in a particular instance by a letter addressed to the commission, by M. Kittl, the director of the conservatory at Prague, who states that the Emperor Alexander I., upon becoming proprietor of an Austrian regiment, ordered new instruments to be made for the band. The manufacturer, in order to increase the brilliancy of tone, raised the pitch considerably. This having produced the desired effect, the example was followed by other military bands, who all raised their diapason.

With the view of obtaining as much valuable information as possible upon the subject, which is one of universal interest to musical art, the commission wrote to all the most celebrated musical centres in England, Belgium, Holland, Italy, and America. Almost all the answers which they received agree in their estimation of the importance of the subject, and in deprecating the undue height of the diapasons now in use. Some of these communications, coming as they do from composers and conductors of the first eminence, are very interesting. It would, however, occupy more space than we can afford to attempt anything more than a very brief mention of one or two of the most striking. Reissiger writes from Dresden that he hopes all Europe will warmly applaud the establishment of the commission. The great elevation of the pitch, in his opinion, destroys the effect and effaces the character of ancient music—of the masterpieces of Mozart, Gluck, and Beethoven. Ferdinand David, Franz Abt, and Lachner, express with equal decision their aproval of the step which the French Government has taken. Herr Wieprecht, the director of the military music of Prussia, and Dr. Furke each forwarded able papers upon the subject, and manifested a lively sympathy with the objects which the Commission had in view. From several quarters tuning forks, to the number of twenty-five, were received. Of these Messrs. Broadwood sent three, which afford a striking example of the necessity which exists in our own country for some readjustment and assimilation of the pitches now in use. The first is a quarter of a tone lower than that of Paris, and is used exclusively for pianofortes destined to be employed for the accompaniments at vocal concerts. This, it seems, was the pitch used about thirty years ago by the Philharmonic Society. The second, which is higher than the Paris pitch, is that to which Messrs. Broadwood ordinarily tune their instruments, as being most likely in general to be in tune with harmoniums, flutes, &c. It is the diapason of instrumentalists. The third, still higher, is that now used by the Philharmonic Society, and, with one exception—viz., that employed in the band of the Belgian regiment of Guides—is the highest which the Commission received. This latter vibrates nine hundred and eleven times in a second, whereas the No. I. of the Messrs. Broadwood, the lowest of all the tuning forks sent in, gives only eight hundred and sixty-eight vibrations in the same time. This difference is nearly equivalent to a semitone.

With these and various other similar communications before them, the commissioners unanimously came to the conclusion that it was desirable—first, that the diapason should be lowered; and, secondly, that when so lowered, it should be taken as an invariable regulator. The determination of the particular diapason to be adopted naturally presented considerable difficulties, and accordingly led to some diversity of opinion. All agreed that a depression of more than a semitone was neither practicable nor necessary. One member alone advocated a depression of less than a quarter of a tone. He, indeed, proposed that the alteration should at the most extend to half a quarter of a tone—fearing that any greater change, coming suddenly into operation, might act prejudicially upon the trade in musical instruments, which is one of the most successful branches of French industry. It is difficult, however, to see much force in this objection, when we consider the great variety which exists in the diapasons already in use throughout Europe. In a letter addressed to the Minister of State by the principal French instrument-makers, they enlarge upon the embarrassment resulting " from the continually increasing elevation of the diapason, and from the variety of diapasons," and go on to request his Excellency " to put an end to this kind of anarchy, and to render to the musical world a service as important as that rendered to the industrial world by the creation of a uniform system of measures." It is evident from this that the manufacturers themselves do not regard with apprehension the contemplated change of diapason.

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* Rapport présenté à son Excellence le Ministre d'Etat par la Commission chargée d'établir en France un Diapason Musical Uniforme.

Ultimately, a depression of a quarter of a tone was fixed upon. This, it was thought, would afford an appreciable relief to vocalists; and, " without introducing too great a derangement in established habits, would insinuate itself, so to speak, *incognito* into the presence of the public. It would render the execution of the ancient masterpieces more easy; it would lead us back to the diapason employed (in Paris) about thirty years ago—the period of the production of works which have, for the most part, retained their places in the repertory, and which would accordingly be restored to the original condition of their composition and representation. It would also be more likely to be accepted in other countries than the depression of half a tone." In accordance with the recommendations of the commission, an official order has been issued, establishing by law a uniform pitch to be used by all the musical establishments of France which have any connexion with the Government. This "normal diapason" is an A, given by a standard tuning-fork to be preserved at the Conservatoire, which vibrates 870 times in a second. All musical establishments authorised by the state must be provided with a tuning-fork verified and officially stamped as consonant with this standard. These regulations come into force on the 1st of July next for Paris, and on the first of December for the departments.

Such are the energetic steps which the French Government has taken in a question which, in our own country, would probably be thought far too trivial to call for state interference of any kind. It would, moreover, in all probability, be almost impossible for us to effect any analogous reformation in the musical world by means of official legislation, inasmuch as we have—and we regret that it is so—scarcely any musical establishments which are dependent for their support upon the Government, or which can in any way be said to have a national character. Much, however, might be done by private combination. If such men as Professor Bennett, Mr. Costa, Mr. Benedict, Mr. Alfred Mellon, and Messrs. Broadwood could, upon consultation among themselves and with others of our more eminent musicians and instrument-makers, come to some understanding upon this question, and would offer their suggestions to the world, it would not improbably lead to a reform which, as we have before remarked, is even more pressingly called for in our own country than in France, where the movement has originated. It would, at any rate, be satisfactory to know the opinion of the men who, in England, are best qualified to speak authoritatively upon the subject.

ON A NEW METHOD OF MANUFACTURING AMMONIA.

By Alexander Williams, Neath.

The importance of ammonia, and its sister compound, nitric acid, in an agricultural point of view, as forming probably the chief sources whence the nitrogen of plants is obtained, and the high commercial price of compounds containing either of these substances, have led practical chemists to look upon any new method of obtaining them as one of the great desiderata of the day.

The atmosphere, with its water, contains the elements necessary for the formation both of ammonia and nitric acid, and during the passage of electricity both are formed; but, so far as our present knowledge extends, and from a long series of experiments on the subject, I am led to believe that it will be some time ere the Society's premium will be claimed " for the production of ammonia, or nitric acid *from their elements*, by methods which would admit of practical application."

After having been engaged for many years in experiments on this subject, I have arrived at the conclusion that, except under peculiar circumstances, nitrogen and hydrogen in their gaseous, or elementary state, will not combine together in sufficient quantities to be commercially available. To make them unite in any quantity it is necessary that the nitrogen should, in its nascent state, be brought in contact with the hydrogen, when union will take place, but this combination is much more readily effected if both be in their nascent state.

To obtain nascent nitrogen it is of course necessary to decompose one of its compounds, and thus far I had only arrived at the same conclusion as every one else. The object of this paper is to direct attention to a bye-product of one of our most important chemical manufactories, which is exactly adapted for our purpose.

The animal and vegetable kingdoms have been so thoroughly searched by the shoals of manure manufacturers of this and other countries, that the discovery of any new nitrogen compound in these kingdoms seems to be altogether improbable; one is therefore naturally led to the mineral kingdom, and our ideas as naturally become fixed on nitrate of soda as the cheapest source. It has been known for years that nitric acid, or other compounds of nitrogen and oxygen could be converted into ammonia, and therefore the use of a nitrate would present no novelty; but if we can obtain the nascent nitrogen from nitrate of soda as a bye-product, we shall have made a grand step towards facilitating the manufacture of ammonia.

This, I believe, I have accomplished. Of the thousands of tons of nitrate of soda annually imported into this country, I have been told, on good authority, that about half is used in the manufacture of sulphuric acid. It is well known that sulphuric acid is usually manufactured in a large leaden chamber having attached to it a burner where sulphur is kept constantly burning, by which it is converted into sulphurous acid. The great difficulty of the manufacture is to give another atom of oxygen to this sulphurous acid ($S\,O_2$) to convert it into sulphuric acid ($S\,O_3$), and it is for this purpose that the nitrate of soda (cubic nitre) is used, and usually in the following manner:—One or more moveable iron pots are placed in the burner. Into each of these pots is put, as often as required, a few pounds of nitrate of soda, and with it a sufficient quantity of sulphuric acid to decompose it. Sulphate of soda (salt cake) remains in the pot, whilst nitric acid and probably other compounds of nitrogen and oxygen pass with the sulphurous acid into the leaden chamber. The sulphurous acid ($S\,O_2$) gains an additional atom of oxygen from the nitrogen compounds, and becomes converted into sulphuric acid ($S\,O_3$) which, with water afforded by steam jet or otherwise, condenses as a liquid at the bottom of the chamber, whilst a quantity of gas escapes.

Such is a rough sketch of the first part of the process usually adopted for making sulphuric acid or oil of vitriol, and the gas which escapes from the vitriol chamber must now be the subject of our inquiry.

On referring to Dr. Ure, our great authority on manufacturing chemistry, I found that he asserts that, in a properly working chamber nothing but nitrogen gas should escape; in fact, that the whole of the oxygen should be taken up, and that the nitrogen should be reduced to its elementary condition. This, although the generally received opinion of the manufacturing chemists of the present day, appeared to me fallacious; as, on considering the affinities, I did not think it probable that sulphurous acid, although it is known to form a compound with nitric oxide ($N\,O_2$), should, under the circumstances occurring in the vitriol chambers, be able to decompose it. Experiments were immediately instituted to ascertain the truth, and they led to the knowledge of the fact that a chemical compound of nitrogen and oxygen was escaping, and not free nitrogen. What particular compound of nitrogen and oxygen it is has not been ascertained, as the fact of its being a *chemical* compound was sufficient for the purpose intended, viz., of applying this waste product for the manufacture of ammonia.

At the commencement of the year 1856, I transferred a portion of the gases escaping from a vitriol chamber to my own laboratory, and there and then succeeded in converting them into ammonia.

This was an important step, but I did not feel satisfied until I had tried the process on the large scale; therefore, in November in the same year, an arrangement was entered into for this purpose with Messrs. Lewis and Pollard, of the Pontardawe Vitriol Works, whose kind assistance in the matter I take this opportunity of acknowledging.

The apparatus fitted up was of the following description:—A furnace was built above the exit tube of one of their vitriol chambers, and a brick gas retort, about 14 inches in diameter, 8 feet long, and open at both ends, was passed through its whole length. This retort was filled with charcoal, and kept at a red heat; the exit tube of the chamber, and a steam-jet to supply the hydrogen, were attached to one end, whilst to the other end was fixed an upright leaden cylinder, filled with coke, and moistened with diluted sulphuric acid. On passing the waste gases and steam through the retort containing red-hot charcoal, both were decomposed, the oxygen of each uniting with the charcoal to form carbonic acid ($C\,O_2$); the nitrogen and hydrogen combining to form ammonia ($N\,H_4\,O$, or, without water, $N\,H_3$); then together, probably forming carbonate of ammonia ($N\,H_4\,O_1\,C\,O_2$), which was again decomposed by the diluted sulphuric acid, the sulphate of ammonia being found remaining in solution. This solution was then evaporated, and in July, 1857, I first had the pleasure of obtaining any quantity of crystals of sulphate of ammonia, by this process, from a vitriol chamber in actual work.

It was the intention at that time to have secured the invention by patent, and therefore, when the above comparatively rough result had been obtained, the further prosecution of the experiments to ascertain yield, &c., was not proceeded with, lest the process should become public. Several circumstances have since prevented their renewal. I therefore merely wish to offer the process as it is to those interested in the matter, hoping some one else may apply it more profitably than I have, and feeling sure that—as there seems no reason why it should not be successfully carried out—it will be the means of advancing the "arts, manufactures, and commerce" of this country, by increasing the supply of one of our most valuable fertilizers.

Perhaps it may be thought that the process is only adapted to such gases as escape directly from the chamber, and that, if any of the late improvements as coke cylinders, &c., be used, it cannot be applied; but provided the assertion be correct that sulphurous acid is incapable of reducing compounds of nitrogen and oxygen to their elementary state, then the process will be available after all these improvements have been carried out, and not only to the waste gases, but also, by a slight modification, to any nitrogen compounds that may have been absorbed by the dilute sulphuric acid, and be given off in its evaporation, so that really a very minute portion only of the nitrogen contained in the nitrate of soda need be lost.

With regard to the quantity obtainable by these means, I have not as yet been able to ascertain with certainty the amount of nitrate of soda imported, but, as already stated, it appears probable that about half of the whole quantity arriving in this country is used in the manufacture of oil of vitriol, or sulphuric acid. Now every thousand tons of this cubic nitre, allowing 10 per cent. for impurities would, if the whole of its nitrogen were converted into chloride of ammonia ($N\,H_4\,O$), yield about 565 tons of this substance, which, at £30 per ton, would be worth nearly £17,000, and there are doubtless many thousands of tons of nitrate of soda used by the vitriol makers of this country. Although these figures give, of course, no approximation to the practical yield likely to be afforded by this process, yet they enable us to form a very good idea of the enormous amount of valuable material daily wasted. The process suggested, or some modification of it. may render this waste unnecessary, and thus save the pocket of the manufacturer, and at the same time benefit the public.

ON TIMBER FOR SHIPBUILDING.

The following has been received from the Editor of the *Mechanics' Magazine*:—

From the Paper read before the Society of Arts last week, by Mr. Leonard Wray, it appears that the aggregate tonnage (register tonnage, we presume) of the merchant shipping of the United Kingdom was last year 4,325,242 tons; and that of the Royal Navy is certainly not less than 1,000,000 tons more. When we consider that a very large proportion of these vessels are built entirely of wood, and that in twenty years at the farthest these magnificent fleets will have fallen into decay and disappeared, we may well view with interest any attempt to point out the means of increasing the durability of the materials of which they are composed, or obtaining fresh supplies for their constant reconstruction. In addition to the demands made for timber for these purposes, it appears, from an estimate which enters with considerable minuteness into detail, that ten times as much is required for the construction and repair of buildings, implements of husbandry, machinery, canals, bridges, docks, &c.

The proportion of this vast amount of timber material which could by any possibility be grown on our own soil is very small. It was found in 1816, when the demand was more limited and our stock of timber much greater than now, that the cost of timber imported was equal to the value of that grown on the soil; and since this time the deficiency in the home supply has been constantly increasing. We have seen ships standing week after week, and month after month, in our Royal Dockyards, while the purveyors were out in the forests endeavouring to find suitable timber, not only for stems and stern posts, and other principal portions of the frame, but even for the catheads from which the anchors were to hang; and any one may see by a visit to our dockyards with what difficulty the frames of ships now on the Government slips are obtained, and how greatly the amount of work on them is increased by the choking and patching to which the builders have to resort. But we are beginning to be reconciled to this state of things, and to look forward with some degree of complacency to the time when our little island must cease altogether to supply her hearts of oak to furnish homes for her seamen. The bare possibily of such a catastrophe was viewed by our forefathers with horror. We find Henry VIII. passing stringent laws for the preservation of timber, "perceiving and right well knowing the great decay of timber and wood universally within the realm of England." By Elizabeth it was enacted that if any idle person cut or spoiled any wood or underwood, pales, or trees standing, and could not pay the satisfaction required, they were to be whipped. Receivers of such wood, knowing it to be so, incurred the same punishment. The 15th of Charles II., cap. 2, is an Act to render that of Elizabeth more effective; and it enacts further punishment, because the destruction of wood tends to destroy the commonwealth. It is therein declared that the officers of justice may apprehend even on suspicion of having carried, or in any way conveyed any burden or bundle of wood of any kind, underwood, poles, young trees, bark, or bast of any tree, gate, stile, post, rail, hedgerow wood, broom, or furze. For the first offence, on conviction, to be fined at the discretion of the justice, not exceeding ten pounds; or be sent to the house of correction for any time not exceeding one month; or be whipped. For the second offence the offender was to sent to the house of correction for one month; for the third he was to be deemed an incorrigible rogue. In Scotland it was enacted, in the reign of James I., that every heritor worth one thousand pounds of yearly valued rent, was to enclose four acres of land yearly, at least, and plant the same about with trees of oak, elm, ash, plane, willow, or other timber, at three yards' distance; and that all other heritors were to enclose and plant for the space of ten years in proportion to their yearly rental. Such enclosed lands were to be free from all taxes whatever, or quartering of horses, for nineteen years. Any persons destroying timber, not being their own property, were to pay £20 for each tree, or work six weeks for the person injured for their meat and drink only. Similar laws were passed for Ireland in the reign of William III., besides which it was required that 260,600 trees should be planted in the kingdom under the direction of the parish officers. And by George III. it was enacted for Ireland that any person who should have in his possession any timber tree, or any kind of wood, pole, stick, &c., and could not give a satisfactory account of how he became possessed of the same, or should pick up branches or shrubs of trees having the leaves on them, in any church, chapel, &c., holly, bay, yew, or laurustinus, and should be convicted on oath, should pay a fine not exceeding £5, or be imprisoned not exceeding six months.

In our own times we sometimes hear enthusiasts proposing to compel railway companies to plant oak trees along the lines, and to take other active means for staving off the threatened calamity; but people seem generally prepared to accept it with resignation. One cause of this probably is, that the comparative cheapness of foreign timber has brought it into very general use, and another that iron has taken the place of wood so largely. This latter cause holds with regard to ship-building timber, not only on account of the large present consumption of iron, but from our faith in its powers, and in the vastness of our store, should we be driven to its nearly exclusive use. Mr. Wray has, however, done well in the very interesting paper which will be found in another part of this number, in bringing under the notice of ship-builders numerous valuable woods of which no use has hitherto been made. In addition to those given by him, we believe there is excellent timber, perfectly accessible, on the Atlantic seaboard of Brazil. There is in particular the *Secupira preta*, the growth of which is very crooked. Its weight is said to be from forty-eight to fifty-nine lbs. per cubic foot, *i.e.*, slightly greater than that of English oak; the grain is curly, and not liable to split with fastening. It is used by the Brazilian Government in the construction of their vessels, especially in the curved parts of the frames. There is a frigate belonging to that government, called the Prince, now in use as a sheer hulk in the harbour of Rio de Janeiro, which was built of this wood forty years ago, and is reported to be in good preservation. The *Secupira preta* can be obtained in abundance at Alagoas, a place near Pernambuco, which is a seaport and a mail station. There is another very crooked and useful wood, called *Pao d'arco*, or arch wood, weighing fifty-five and a half lbs. to the foot, and growing at Bahia, also on the sea-coast; and another, *Canella preta*, still lighter—about fifty and a half lbs. to the foot—but equally durable, and grown on the southern portions of their seaboard. When we consider the cost of English oak—as much as 9s. per cubic foot of the largest sizes—and its great scarcity, involving serious delays in the construction of ships, and much costly and clumsy patching, we think it high time that the Government took steps towards introducing some foreign timber for the frames of our ships of war. In the merchant service—as may be seen from Mr. Wray's paper—several kinds of foreign timber are admitted on equal terms with English oak. In the Government service it is not so. If we except Polish and Italian larches, and Pitch-pine, which are occasionally admitted in small quantities, the frames of all ships built in the home yards are of English or Italian oak. We do not believe there is the least necessity for this—but that on the contrary, there are many and unanswerable reasons for discontinuing the use of oak timber of home growth, at least in the *frames* of ships, altogether. The feeling is, however, so strong in favour of English oak, that merchant builders still employ it largely, though in the majority of cases they pay dearly for it—for the timber which they can afford to use is small, and, to a great extent, spring-felled and unseasoned, and therefore subject to early and rapid decay.

It was our intention, had space permitted, to go into the question of the preservation of timber. We know something of the specifics which have been received into favour at different periods of our naval history, and we quite dissent from Mr. Wray's statement, that there are "simple, well-known remedies" for the prevention of dry-rot. That he is right, however, in predicting that dry-rot will make swift havoc in the newly-converted steam-ships we think probable, and we purpose taking an early opportunity for considering the question. In the meantime, if Mr. Wray, or any of our readers have any well-authenticated experiments on the preservation of the frames of ships by the application of antidotes to dry and wet-rot, we shall be very glad to consider them, and to lay them before our readers.

Home Correspondence.

IRON SHIPS OF WAR.

SIR,—On reading Mr. Wray's letter on the above subject, I find that in the remarks which I made at the meeting of your Society on the 6th inst., I negligently substituted the words "shot" for shell," and "shot-proof" for "shell-proof." I very much regret this error, as it has put Mr. Wray to the trouble of using arguments which would not otherwise have been called for. I would here repeat, what I said at your Society in December last, viz., that "the attempt to build ships which shall be proof to solid shot—at least to wrought-iron solid shot—is an altogether illusory one."

I shall not presume to follow Mr. Wray in his discussion of the general qualities of iron-coated ships. I will merely say that very destructive shells *are* now used in naval warfare, and I know of nothing to prevent the adoption of others still more destructive; and further—with regard to the French shell-proof ships—I think it unwise to trust to capturing them by boarders; and this opinion is shared, I know, by many experienced naval men.

Apologising for thus troubling you, and thanking Mr. Wray for his polite attention to this matter,

I am, &c.
E. J. REED.

166, Fleet-street, London, May 13, 1858.

WATER GAS.

SIR,—Under the above heading I notice an article in last week's number of the *Journal of the Society of Arts*, which gives a history of what has been and is being done in this mode of producing light.

A long list of honoured names is given of men who have attempted to produce illuminating gas by the decomposition of water—most of whom have effected this object by passing water or steam through incandescent coke or charcoal, and afterwards carbonizing the resultant hydrogen or carbonic oxide with the rich gas produced either from resin, oil, or cannel, for without this the hydrogen gas so obtained would have no illuminating power, and be only fit for heating purposes.

Unfortunately, I can speak from experience, for I purchased the right of one of the persons mentioned (Webster) to erect gas-works, and I erected several, some eight years ago, in this neighbourhood (but not at St. Ives, as the article states), all of which were complete failures, and the conclusion to which I have long since come is, that coal alone is the cheapest material from which to produce gas for illuminating purposes.

It is true that water may be had for nothing, yet the cost of decomposition and carbonizing the gas obtained therefrom, together with the increased wear and tear, make up a total considerably in excess of that which is necessary to obtain gas of a high illuminating power from coal.

But as these remarks apply only to the process of producing gas where decomposition of water, and carbonizing the products obtained, are done separately, it may be said that the process of M. Gillard, which the article describes, supersedes the necessity of carbonization, and that, therefore, his is a perfected system, and one which will supplant coal gas, because hydrogen alone is made to produce a light of considerable power. I propose then to examine his method, and to show what he has done in the places which he has lighted.

It may be premised that artificial light is produced by the incandescence of solid matter, held in suspension in an inflammable gas, and there may either be too little or too much of this solid carbon; if the former—there is but little light; if the latter, the heating power of the hydrogen is not sufficient to convert the whole of it into luminous particles, so they only become charred, and thus form charcoal or soot.

Now M. Gillard produces luminosity by the incandescence of platinum wire, as his gas does not contain any solid matter, and therefore he adopts this expedient; but I am at a loss to know how M. Gillard claims this as his invention, for I find in a paper read before the Royal Society in 1817, by Sir Humphrey Davy, that he gives a description of a method by which light may be produced with mixtures of coal-gas and air, or with fire-damp (which is light carburetted hydrogen), and he gives drawings of his application. The following is an extract of his description:—" J is a small cage, made of wire of platinum, of 1-70th or 1-80th of an inch in thickness, for giving light in inflammable media," so that I think to Sir H. Davy is due the merit of being the first to apply platinum as a light-giving agent, in inflammable gases not possessing any such property.

With regard to the super-heating process described in the *Journal*, one of Webster's plans was to pass the steam through an iron box, perforated with minute holes, placed at the end of the retort, before it came in contact with either coke or charcoal, and this was adopted in the works which I erected.

I notice that the city of Narbonne is mentioned as being one lighted by the Gillard or Davy system, and that M. Gillard is under contract to light 500 public lamps for three years.

I am informed that the only portion of Gillard's plan still retained at Narbonne, is the application of the platinum cage, and that this mode of producing hydrogen has been supplanted by that of another person—his being considered a failure. My authority for the assertion is the *Journal de l'Eclairage au Gaz*, published at Paris, and if any one wish for a full report on "Le Gaz à l'Eau à Narbonne," I would refer him to an article thus headed in the above journal of the 5th February, 1858, the substance of which is this—that to produce 800 cubic metres of water gas at Narbonne costs 154 francs 47 centimes, while the same quantity of coal gas could be produced for 107f. 61c.; and the editor then truly enough says—"If the lighting power of the water-gas would compensate for the difference in the cost between it and coal gas, we could understand why it should be preferred, but precisely the contrary is the case."

I believe it is a well understood fact that to produce the same amount of light by water gas and platinum as from coal gas, double the amount of the former has to be used, so that it is indeed difficult to discover where the advantage of using this gas can be when, in addition, it costs more than coal gas in the first instance; but this is not the only disadvantage it has; the heat produced is very great, and there must of necessity be a considerable deposition of water by condensation on the coldest portions of rooms, when the gas is used by the union of atmospheric oxygen (substituted for that which it lost when the water was passed through the incandescent charcoal) with the hydrogen. Again, if the platinum becomes in the slightest degree cooled, the illuminating power must be diminished, as it is the intensity of its heat which gives the light.

I believe Palma, in the island of Majorca, has been lighted by M. Gillard since Narbonne, and that the whole process has been abandoned in favour of coal gas.

I will only add that, as a gas engineer, I would be among the first to adopt any system which would give a better and cheaper light than that which I can get from coal, whether it were made from liquid or solid—but so long as ordinary Newcastle coal keeps under 50s. per ton, there is not, in my opinion, any substance which can at all enter into successful competition with it.

I am, &c.,
GEO. BOWER.

St. Neot's, Huntingdonshire, 9th May, 1859.

FREE LIBRARIES AND MECHANICS' INSTITUTIONS.

It may be interesting to those readers of the *Journal of the Society of Arts* who value such institutions, to know that a very handsome building has been raised and devoted to the purposes of a Free Public Library (under the Libraries Act) at Lichfield, within the present month. Lord Lichfield presided, and Lord Hatherton and others assisted, at the opening of it. It is well-supported by the Corporation funds as well as by the rate.

I observe a question raised in the *Journal* as to the interference of Free Libraries with Mechanics' Institutions. I am not aware that any results detrimental to Mechanics' Institutions have arisen at Liverpool, Manchester, and other places where libraries have been founded under the Act. I should be disposed to think that a wider opening of the market of literature would (as in matters of trade) eventually do such general good, as to benefit even special Institutions. I am, &c.,

WM. EWART.

Broadleas, Devizes, May 15.

ORIGIN OF THE ELECTRIC TELEGRAPH.

Sir,—In last week's number of the *Journal* there is a notice of Dr. Hamel's communication to the Russian Academy of Sciences, relating to the first telegraph worked by galvanic electricity, which appears to have been constructed in 1809.

It may be interesting to direct attention to a much earlier use of vitreous electricity for the communication of signals to a distance. This will be found in "A letter to C. Mortimer, M.D., Sec. R.S., containing several experiments concerning Electricity, by Mr. Stephen Gray." This is dated, Feb. 8th, 1731, and was published in the *Philosophical Transactions* for 1731, pp. 18-44.

From this it appears that, in August, 1730, Gray suspended an insulated silk line on 15 pairs of poles, and electricity, developed by friction on glass, placed near one end of the line, caused brass leaf to move at the other, through a length of 886 feet of silk. Another letter from Gray (p. 228) shows he had found that water could convey the electric "effluvium" (as it was termed) in the same manner as silk.

Attention has also been called by Mr. F. Tolhausen, of Paris, to a recent number of *La Presse*, in which the Abbé Barthelemy is said to have suggested an electric telegraph in his well-known work "Voyage du Jeune Anacharsis," which appeared in 1788.

I cannot yet find the exact page of this work for reference, but the passage may be translated as follows:—"It is said that with two clocks (*pendules*, not *horloges*,) of which the hands are similarly magnetised, if we move one of these hands the other would at once turn in the same direction, so that if 12 o'clock were to be sounded on one, the same hour would be sounded on the other. Suppose we could so improve artificial magnets that their power could communicate itself from here to Paris, you would have one magnet and we another. In place of hours, we should have on a dial the letters of the alphabet. Every day, at a given time, we should turn our pointer, and M. Viart read off thus:—'Good day, my dear girl.' That is what grandmama would say. As for me, when my turn comes I will say almost the same. You will perceive that one might still further facilitate the operation, for the first movement of the needle could sound a bell, which would announce that the oracle is going to speak. This idea pleases me amazingly. It would degrade such an invention very much to apply it to getting information in war and politics, but it would be a very pleasant means of communication between friends."

The writer in *La Presse* says we must expect next to find the railway locomotive explained in some ancient Sanscrit manuscript.

I am &c., J. MACGREGOR.

Temple, May 16.

To Correspondents.

In the last number of the *Journal*, in the article:—"The Origin of the Electric Telegraph," p. 453, col. 2, line 16, where it is mentioned that Baron Larrey presented Soemmerring's Telegraph to the National Institute of France on the "4th of December," read "5th of December."

MEETINGS FOR THE ENSUING WEEK.

MON. ......Royal Geographical Anniversary, 1 P.M., when the Gold Medals will be awarded to Captains Burton and Palliser by the President, Sir R. S. Murchison, who will then deliver his address on the Progress of Geography. The dinner will take place at the Freemason's, at 7 P.M.
TUES. ......Linnæan, 1 P.M. Anniversary
Royal Inst., 3. Professor John Morris, "On Geological Science."
Civil Engineers, 8. "On the Manufacture of Malleable Iron and Steel," by Mr. H. Bessemer.
Medical and Chirurg., 8½.
Zoological, 9.
WED. ......Royal Soc. Literature, 4½.
Society of Arts, 8. Mr. John Bell, "On the Application of Definite Proportions and the Conic Sections in Architecture; illustrated chiefly by the obelisk, with some History of that feature of Art."
Archæological Assoc., 8½.
THURS .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Philosophical Club, 5½.
Numismatic, 7.
Antiquaries, 8.
Philological, 8. Anniversary.
Royal, 8½.
FRI. ......Royal Inst., 8½. Mr. Wm. Pengelly, "On the Ossiferous Caverns and Fissures in Devonshire."
SAT..........Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."
Royal Botanic, 3¾.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered on 14th April, 1859.

107. Bills—Vexatious Indictments.
109. ,, Manslaughter (as amended by the Lords).

Delivered on 15th April, 1859.

202. Army (Mortality, &c., at Trinidad)—Return.
207. Lunatic Poor (Ireland) Bill—Minutes of Proceedings of the Select Committee.
143. East India (Lands in Enam)—Return.
108. Bills—Clearance Inwards and Lien for Freight.
110. ,, Court of Probate, &c. (Acquisition of Site) (as amended by the Select Committee.)
Medical Charities (Ireland)—7th Annual Report of the Commissioners.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May* 13, 1859.]

Dated 30th March, 1859.

790. W. Brown, Bolton-le-Moors, Lancashire—Imp. in manufacturing clog soles, and in the machinery employed therein.

Dated 2nd April, 1859.

834. T. Williams, Aberdaron, Caernarvon, and J. H. Fuller, 70, Hatton-garden—Imp. in screw stocks and dies.

Dated 4th April, 1859.

338. C. F. Kirkman, Argyll-street, Regent-street—Imp. in the manufacture of cocoa-nut fibre yarn and matting.

Dated 5th April, 1859.

848. A. Shanks, 6, Robert-street, Adelphi, Westminster—Certain imp. in machinery for forging and stamping metals.
856. T. Scott, Dundee—Imp. in preparing, treating, or manufacturing fibrous materials, and in the apparatus employed therein.

Dated 9th April, 1859.

886. T. Spencer, 192, Euston-road, Euston-square—Imp. in the economical treatment of refuse or waste matter containing sulphur.

Dated 11th April, 1859.

898. B. Baugh, Bradford-street, Birmingham—Certain improved arrangements for working fly presses by steam, water, or other power.
900. W. Schofield, 13, Thomas-street, Stamford-street, Blackfriars-road—An improved effervescing lemonade.

Dated 13th April, 1859.

926. R. Coleman, Chelmsford—Imp. in agricultural implements.
930. J. A. Coffey, 4, Providence row, Finsbury—Imp. in apparatus for heating liquids.

Dated 14th April, 1859.

934. J. Gillett, Upper Brailes, Warwickshire—An improved mill used for grinding, crushing, and reducing bones and other mineral and vegetable substances.
936. T. Bird, Manchester—Imp. in the application and use of a certain natural product or products in the manufacture of pickers for looms, drawing rollers for spinning machinery, cop tubes, and for steps and bushes generally where lubrication is required.
938. J. Beattie, Lawn place, South Lambeth—Imp. in the means of preventing locomotive engines and carriages in motion on railways leaving or running off the rails.
940. W. Barnes and S. Pickering, 127, Brick-lane, Spitalfields, and J. Roberts, William-street, Limehouse—Imp. in retarding and stopping railway locomotives and trains.
942. W. Sinnock, Brompton—Imp. in submarine and subterranean electric telegraph cables, and in machinery for the manufacture thereof.
944. L. J. Higham, New York, U.S.—Imp. in billiard tables.

Dated 15th April, 1859.

948. J. Chapman, Wolverhampton—An imp. or imps. in the manufacture of angle iron.
950. R. Boot, Hill-street, Surrey—Imp. in treating sheep or other pelts, so as to give them the appearance of rough calf.

Dated 16th April, 1859.

952. H. Barrow, Birmingham—A new or improved fastening for fastening trunks, boxes, and articles of dress, and for such other purposes as the same is or may be applicable to.
954. J. Glasgow and S. Hand, Manchester—An improved variable circular motion applicable to slotting, shaping, and planing machines, or similar purposes.
956. W. Clark, 53, Chancery-lane—Imp. in apparatus for separating metals from their ores and other matters. (A com.)
958. J. Hamilton, 8, Exchange-square, Glasgow—Imp. in apparatus for regulating prime movers driven by water.
960. H. Harrison, Blackburn, Lancashire—Certain imp. in looms for weaving.
962. H. H. Vivian, M.P., Swansea—Imp. in smelting copper.
964. G. B. Cornish, New York, U.S.—Imp. applicable to fog horns.
966. J. Moule, Seabright-place, Hackney-road—A new compound liquid for illuminating purposes.

Dated 18th April, 1859.

968. R. Warry, Chatham—Imp. in breech-loading ordnance and its projectiles.

970. G. Porter, London—Imp. in valves or cocks.

972. J. Seaman, Linslade, Buckinghamshire—Imp. in agricultural implements for working or cultivating the soil.

974. J. C. Wilson, Wood-street, London—A reversible shawl cloak.

978. J. Morton and S. H. Morton, Sheffield—Imp. in hearth-plates or ash-pans.

980. G. Coller, Harlow, Essex—An improved mowing machine.

982. W. Parsons, Pontar-Tawe, near Swansea—Imp. in preparing sheet iron and other metal sheets for japanners and other uses.

Dated 19*th April*, 1859.

986. C. Batty, Manchester—An improved means or apparatus for effecting instantaneous communication on railways between passengers and officials.

990. J. W. Matthews, High-street, Poplar—An imp. in the manufacture of hats, and other coverings for the head.

Dated 20*th April*, 1859.

992. Q. Beck, Belfast—Imp. in stoves. (A com.)

994. J. M. Johnson and E. Johnson, Castle-street, Holborn—Imp. in the production of ornamental surfaces suitable for advertisement tablets, plates for shop fronts, and for other uses.

996. H. Rawson, Leicester—Imp. in machinery for combing wool and other fibres.

Dated 21*st April*, 1859.

1000. E. Cottam, Pimlico—Imp. in apparatus employed for cutting or sawing metals and other substances.

1002. J. Napier, Partick, near Glasgow—Imp. in producing figures or representations upon glass.

1004. J. Davies, Tetbury, Gloucestershire—A new or improved apparatus for ringing door bells, and a bolt to be used with the same apparatus, and for other purposes to which the said bolt is or may be applicable.

1006. R. A. Brooman, 166, Fleet-street—Imp. in knitting frames. (A com.)

1008. E. Clark, New York—Imp. in sewing machinery. (A com.)

1010. S. Truss, Darlington, Durham—Imp. in the construction of pipes, and in the mode of joining the same.

Dated 23*rd April*, 1859.

1014. C. Mansel, Plymouth—A folding travelling case.

1016. J. Armstrong, Sunderland—Imp. in drying and preserving timber.

1018. J. Angus, Glasgow—Imp. in saddles.

1020. P. L. M. Debain, Paris—Improved means for transmitting motive power to ships, pumps, and other arrangements by which the displacement of fluids is effectuated.

1022. P. L. M. Debain, Paris—Imp. in making heat subservient for producing motive power.

1024. R. A. Brooman, 166, Fleet-street—An improvement in the manufacture of woollen cloth. (A com.)

1026. W. Moxon, Parliament street, Westminster, and J. J. Bennett, Homer-terrace, Victoria-park, Middlesex—Improved apparatus for raising or lifting and lowering heavy bodies.

Dated 25*th April*, 1859.

1028. W. Stevenson, Johnstone Renfrew, N.B.—Imp. in spinning, doubling, and manufacturing cotton and other fibrous materials.

1030. J. Higgin, Manchester—Imp. in treating madder, and plants of the same family, and preparations therefrom.

1032. J. Owen and H. Duckworth, Blackburn—Imp. in machinery or apparatus for leasing yarns.

1034. T. Buckham, Gloucester—An imp. in railway switches.

1036. A. W. Gadesden, 56, Leman-street, Goodman's-fields—Imp. in producing solutions of sugar.

1038. W. E. Newton, 66, Chancery-lane—Imp. in sewing machines. (A com.)

1040. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin, Tottenham—Improved compounds applicable for packing the joints of steam or other pipes, which compounds are also applicable for packing or lining parts of machinery in general, or parts of ships, bridges, tanks, or railways.

Dated 26*th April*, 1859.

1042. T. Holt, Lower-place, and J. Brown, Oxford-street, Well Field, Rochdale—Imp. in apparatus, or an improved apparatus, for heating water for the supply of steam boilers, which improvements or apparatus are also applicable in some cases for the prevention of incrustation in steam boilers.

1046. R. Main, Birkenhead—Imp. in wheels for carriages.

1048. R. A. Brooman, 166, Fleet-street—Imp. in vulcanizing and colouring caoutchouc, and in the preparation of caoutchouc paints and colours. (A com.)

1050. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for combing wool and other fibrous substances. (A com.)

Dated 27*th April*, 1859.

1052. J. M. Ciroux, Brussels—Imp. in lamp glasses and shades, applicable to gas burners, light houses, and railway signals.

1054. J. Hyde, Hollingworth, near Mottram, Chester—Certain imp. in steam boilers.

1058. R. J. Laing, Haggerstone, Middlesex—Imp. in wet gas meters.

1060. J. Holroyd, Leeds—Imp. in machinery used for finishing woollen and other cloths.

1062. Sir T. T. Grant, K.C.B., 20, Chester-terrace, Regent's-park—Imp. in ships' cooking apparatus.

Dated 28*th April*, 1859.

1066. R. Jones, New Kent-road, Surrey—An improved safety lamp.

1068. N. Libotte, 33, Boulevard St. Martin, Paris—A steam brake for mines, which may also be worked by hand.

1072. J. Wheat, Hinckley, Leicestershire—Certain imp. in drilling machines employed for agricultural purposes.

1074. A. Boyle, Birmingham—Imp. in the manufacture of certain parts of umbrellas and parasols.

Dated 29*th April*, 1859.

1078. H. Bosshard, Paris—An improved mechanism for obtaining and imparting motive power.

1080. S. de Cazenave, 189, Regent-street—An improved lubricating compound.

Inventions with Complete Specifications Filed.

1158. J. Luis, 1B, Welbeck-street, Cavendish-square—A self-regulating horse machine. (A com.)—9th May, 1859.

1161. G. G. Bussey, 485, New Oxford street—An improved contrivance for carrying cartridges and to facilitate using them. (A com.)—9th May, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *May* 13*th*, 1859.]

May 12*th*.

2547. J. Courage and F. Bennett.
2548. J. Taylor.
2551. L. Petre.
2552. I. Livermore.
2557. M. Pullan.
2558. J. A. Hopkinson.
2562. G. Davies.
2568. J. G. Bunting.
2569. J. Brennand.
2571. J. C. Boisneau.
2572. A. I. H. Parent.
2573. J. Samuel.
2575. C. J. C. Perry.
2587. J. Robertson.
2641. D. Evans.
2649. F. A. Theroulde.
2669. J. S. Nibbs.
2702. G. B. Sander.
2723. D. Evans and G. Jones.
2736. R. H. Bow.
2752. J. Lewis.
2779. J. B. A. Monnier.
18. I. Wood.
86. R. Hawthorn and W. Hawthorn.
137. J. Montgomery.
205. W. E. Newton.
435. J. J. Russell.
437. J. Seguin.
568. W. Score.
577. C. R. Mead.
615. J. S. Russell.
630. A. V. Newton.
642. A. Tylor.
705. A. V. Newton.
729. Sir P. Fairbairn and R. Newton.

[*From Gazette*, *May* 17*th*, 1859.]

May 14*th*.

2564. W. G. Armstrong.
2583. C. F. Vasserot.
2584. J. H. Tuck.
2586. E. Welch.
2589. E. Mellor.
2591. J. Brennand.
2592. R. A. Brooman.
2598. S. Riley.
2601. Sir C. T. Bright.
2603. H. Stott.
2608. E. T. Archer.
2612. W. S. Hayward.
2616. W. Hancock.
2618. H. H. Henson.
2619. W. Ramscar & J. G. Scott.
2620. E. A. Pontifex.
2621. H. Bailey.
2622. W. Clark.
2627. A. J. Thorman.
2654. W. Ralston.
2655. W. H. Dawes.
2730. A. E. C. Scheidel.
2764. G. E. Noone.
2773. L. W. Fletcher.
2944. E. Fellows.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette*, *May* 13*th*, 1859.]

May 9*th*.

1105. R. A. Brooman.
1124. H. Tucker.
1162. W. Henderson.
1255. C. Cowper.

May 10*th*.

1206. A. Allan and T. Hunt.
1246. R. A. Whytlaw and A Mitchell, jun.
1270. L. D. Owen.

May 11*th*.

1185. J. Wilkes, T. Wilkes, and G. Wilkes.
1201. A. H. Dufresne.
928. U. Scott.

[*From Gazette*, *May* 17*th*, 1859.]

May 12*th*.

1175. R. Knight.

May 13*th*.

1138. U. Scott.
1150. J. Leck and A. Miller.
1152. H. Greaves.

May 14*th*.

1254. W. Hulse.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4169	April 29.	Latch Lock	Garton and Jarvis	Exeter.
4170	May 4.	Cottam's Saddle and Harness Airing and Drying Horse	Cottam and Company	2, Winsley-street, Oxford-street, W.
4171	,, 7.	An Artificial Breast	Brigg and Millikin	9, St. Thomas's-street, Borough, S.E.

Journal of the Society of Arts.

FRIDAY, MAY 27, 1859.

CONVERSAZIONE.

The Second Conversazione of this Session will be held to-morrow (Saturday) Evening, the 28th inst., at the South Kensington Museum. The doors will be opened at 8 o'clock.

The following divisions of the Museum will be open on this occasion:—

1. The Sheepshanks Gallery of Pictures.
2. The Sculpture Gallery.
3. The Architectural Museum.
4. The Animal Produce Collections.
5. The Ornamental Art Collections.
6. The Structure and Building Materials Collections.
7. The Educational Collections.
8. The Collection of Patented Inventions.
9. The Art Training Schools.

The band of the Coldstream Guards will be in attendance. Carriages are to set down at the refreshment entrance.

EXHIBITION OF INVENTIONS.

The Exhibition was opened on Monday, the 25th ult., and will remain open every day until further notice, from 10 a.m. to 4 p.m., and is free to members and their friends. Members by ticket, or by written order, bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date:—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

TWENTY-FOURTH ORDINARY MEETING.

Wednesday, May 25, 1859.

The Twenty-Fourth Ordinary Meeting of the One Hundred and Fifth Session was held on Wednesday, the 25th inst., Professor Donaldson in the chair.

The following candidates were balloted for and duly elected members of the Society:—

Bendon, George
Charles, William
Davis, John
Dennett, Charles, F.
Dyott, John Philip
Hobler, Francis Helvetius
Jones, Charles Frederick
Norfolk, Horatio Edward
Piggot, Adolphus
Stedall, Robert
Tann, John
Young, W.

The Paper read was—

SOME REMARKS ON THE APPLICATION OF DEFINITE PROPORTIONS AND THE CONIC SECTIONS TO ARCHITECTURE, ILLUSTRATED CHIEFLY BY THE OBELISK, WITH SOME HISTORY OF THAT FEATURE OF ART.

By John Bell, Sculptor.

Few, I suppose, who have been in the habit of looking with interest upon features of architecture, but have noticed the apparent concavity of long perfectly straight and flat forms. One of the most common of these cases is to be found in manufacturing towns, or in any great factory, as the arsenal at Woolwich, where tall chimneys have been built with perfectly straight sides. In regarding these, an appearance of concavity arises, insomuch that those who are not aware of this delusion of the eye, are apt to pronounce the sides actually concave. No precise point or points can, however, be specially indicated for this appearance of insufficiency, which seems rather to wander up and down these tall forms, eating by turns into every part of their outline. So painful is this insufficiency to the educated eye, that even in this strictly utilitarian feature, a slight swell has occasionally been given to obviate this unpleasant effect. Now the adding of a compensatory fullness to lines of this character was not an occasional thing with the Greeks, but was one of their constant architectural principles, as is well exemplified in their columns. It is true that formerly this fact was not sufficiently regarded; nevertheless actual and most precise measurements on the spot have fully proved that this curvilinear treatment of a compensatory nature was universally adopted in the best time of Athenian art.

It appears the more extraordinary that this compensatory treatment should ever have been lost sight of, inasmuch as Vitruvius has, in his well-known treatise on architecture, that text book of ancient art, which was written in the time of the Emperor Augustus, described explicitly this treatment both of upright and transverse lines in architecture, and registered it as a received principle in his time. Thus in Book 3, chap. 2, in speaking of columns, he says—"The eye is constantly seeking after beauty, and if we do not endeavour to gratify it by proper proportions and increase of size, when necessary, and thus remedy the defect of vision, a work will look clumsy and disagreeable." Of the swelling which is made in the middle of columns, which the Greeks call "ἔντασις, so that it may be pleasing and appropriate," he says, "I shall speak at the end of the book." But it is not only of this curvilinear treatment of the upward contours of columns that this ancient authority speaks, but also of applying analogous modifications of the straight line in a delicately arched form to the horizontal lines of buildings. In chap. 3 of the same book, he thus speaks of the line of the stylobata or the upper step on which the columns of a portico or of the front of a temple are placed. "This," he says, "should not be a straight line, but it should be very gently arched, as thus—"The stylobata should be so adjusted that it should be highest in the centre, for if it be set out level, it will have the appearance of being sunk in the centre." In this instance, as well as in the columns, this treatment was applied, to use his own expression "to remedy a defect in vision," or what rather we may prefer to call an optical delusion.

We may remark, *en passant*, that although the clothing of the column with the entasis has now become so received a practice with us that no workman would think of putting up one with perfectly straight sides, yet that few architects have as yet accepted into their practice the same principle of entasis in the long transverse lines of their buildings, although I fully feel with Vitruvius that in order to gift them with complete sufficiency, these also require a slight compensatory treatment. One more quotation from Vitruvius, to bear out that this treatment was also carried into the upper part of the structure. He thus continues, "The capitals, being completed, are to be set on the tops of the shafts, not however level throughout the range of columns, but so arranged with a guage as to follow the inclination which the small elevations in the stylobata produce." Thus a slightly curved line of upward entasis is produced in the range of the capitals or tops of the columns as well as at their bases. So far Vitruvius, and now we will turn for a short space to some results of the investigations which have been made of late years at Athens with respect to the lines of her ancient architecture, by Mr. Pennethorne, Mr. Cockerell, Mr. Donaldson, and Mr. Penrose; the elaborate work by the latter gentleman having now become the text-book on the subject.

Mr. Penrose resided for a considerable time in Athens, and was indefatigable in measuring by the most delicate and accurate means the remains of the Athenian edifices. In his investigation into the principles of Greek architecture, he says, "One of the principal objects of this work is the investigation of the various delicate curves which form the principal architectural lines of certain of the Greek buildings of the best period, which in ordinary architecture are, or are intended to be, straight."

I shall now proceed to lay before you some results of this gentleman's observations in as condensed a form as I am able. First, with respect to the column. For brevity I will confine myself to those of the Parthenon, although his work includes others with analogous results. The sides of these columns of the Parthenon are not straight lines, but are somewhat curved and convex, or, to use the express term, have an entasis on their sides. The term entasis is derived from the Greek verb ἔντεινειν, to stretch a line or bend a bow. Thus the greatest amount of bend has come to be called the arrow or "sagitta" of that bend, and thus when we speak of the amount of the entasis: we say an entasis of such and such a sagitta. Now, the "sagitta" of the entasis of the columns of the Parthenon, that is its greatest divergence from a straight line, is very slight, for it only amounts to $\frac{1}{552}$ part of the whole height of the shaft of the column. This, one might say, is so small that it could not be appreciated, but yet in practice it fully does its duty. The shafts of the columns of the Parthenon do not look hollow on the sides nor weak in their intermediate portions, which they would have done had their contours been perfectly straight. The compensatory curve, "to remedy the defect in vision," has, in this case, been so admirably adjusted as to offer a standard example, not to be surpassed, of this delicate architectural refinement. It naturally next occurred to Mr. Penrose to investigate what exact line of curve this was. He soon discovered it was not to be produced by a circle, however long the radius might be. It could not be a segment of any circle, for in that case the sagitta, or greatest amount of deflection from a straight line, would be at a point halfway up the column, which is not the case; the sagitta being rather between one-third and one-fourth up the column from the base, the curve of this entasis being, in this respect, like that of the flexure of a bow, of which the upper portion is stiffer than the lower. Of course you will keep all this distinct from the general tapering of these columns. All columns of this character taper, which is seen at first sight. What these remarks on entasis apply to, is that they do not taper in straight lines, but in curved ones; of which, although the agreeable result and effect is perceptible to all eyes, yet they are so delicate in their degree of bending, that their curvature is not recognised at first sight, except by an eye expressly educated to the fact. These curved lines of the Parthenaic columns, although they nearly approach to some portions of the conchoid of Nicomedes, and also of the catenary curve, have yet been pronounced by Mr. Penrose to be solely capable of being perfectly afforded but by one geometric line—that of one of the simple conic sections which is called the hyperbola. He thus pronounces the entasis of the columns of the Parthenon to be a portion of a hyperbolic line, of which the more bent part is at the base and the straighter portion towards the top of the shaft. Whether this line was, in fact, obtained by the Athenians from a strict conic section, or by a minute correction of the conchoid, adopted since by Vignola and set forth in Nicholson's method, or by some use of the catenary curve, is not necessary for us here to enter into. Mr. Penrose conducted his investigations on the spot at Athens with the utmost care, and I have no doubt we are ready to accept his acute evidence.

I will now turn to the application of the same principle of delicate curves to the horizontal or, more correctly speaking, the transverse lines of Greek architecture. We have seen that Vitruvius said that these lines should rise somewhat towards the centre, or else they would appear to "sink in the centre," so that this transverse addition, or "entasis," is derived on the same principle as the entasis on the lateral lines of the column, viz., that it should be strictly compensatory. This slight rise towards the centre in a delicate curve Mr. Penrose found on all the principal Athenian structures, not only on the basement and stylobata, but also in the range of the capitals of the columns, and in that of the entablature. In these cases also he pronounces this curve not to be that of the segment of a circle, but that of another of the simple conic sections, the parabola. The line of the front of the Parthenon is rather more than 101 of our feet in length, and the rise in the centre is not more than between two and three inches. As the flanks of the Temple are longer, so in them is the rise somewhat more. These minute corrections are of course only compensatory, and are not obtrusive; nor does there appear any probability of their being accidental, for, fortunately, the Parthenon is built on a rock, and therefore it may be well presumed that these lines have not undergone alteration. Mr. Penrose pronounces these transverse lines to be portions of a parabola. Mr. Jopling has, however, thrown out the practical hint of applying to these transverse lines the catenary curve, which in execution would differ but little from this parabolic line, by a method which has the advantages of simplicity and ease of application. He suggests the arriving at this curve for the stylobata, by stretching a mason's line from end to end of the basement of the building, at such a tightness as would afford the desired degree of curve. He would then simply refer this upwards by measurement, so as to give the upward entasis; simply reversing the catenary curve thus obtained along the whole front of the building, for the upward entasis of the upper step. I am quite inclined also to believe with this gentleman that a portion of one-half of a curve of this nature might also afford a very pleasing contour for the lateral lines of a column, as well as for various other features of architecture. With respect to the whole setting out and structure of the Parthenon, Mr. Penrose holds that even in the body of the building this slight rise in the centre took place. In addition to these modifications also, Mr. Penrose holds that all the tops of the columns inclined somewhat inward towards the body of the temple. We have thus seen that both the upward and transverse lines of the Parthenon are curved with very delicate entases. Mr. Penrose naturally then sought for the same in the roof lines of the tympanum. He found these slightly curved in the Theseum, but not in the Parthenon, where they are straight.

I will not go further into the adjustments of smaller details, having only space for broad features. I am now about to compare the elevation of the obelisk with that of the front of a Greek temple. Although of very different proportions, the two general features possess similar elements—these are the lower and upper transverse lines, the sides, and the roof lines. The shaft of the obelisk answers to the colonnade and entablature, and the pyramidion to the tympanum. In this way we may accept in a general point of view that the front of the temple is a very wide, short, obelisk, and the obelisk a very tall temple. We have seen that the sides of the columns of the Parthenon taper and slope; so do the sides of the obelisk; and we have also seen that these columns do so, not with straight sides, but with sides of very delicate entasis. I conceive that an obelisk should also have a lateral entasis. The lines of the upper step and entablature of the Parthenon have a slight upward entasis; so also in effect should be the case with the analogous lines of the obelisk. I am still doubtful, however, as to the inclined or roof lines of the pyramidion whether to follow the Parthenon or the Theseum. I have tried both, but I think I prefer the straight lines of the Parthenon. I do not wish to push this similitude of the two subjects of art too far, but I think you will allow that they possess in degree the same general elements. I desire, however, now to say a few words on a different and perhaps somewhat novel mode of obtaining a somewhat similar effect of rise in the centre of transverse lines by a different method from that of the Athenians. That is by a convex entasis on *plan* instead of in elevation. I have adopted this mode of *Entasis* on *plan* in the treatment of the obelisk, and hence I naturally came to think of it more generally as applied to other subjects. I conceive that all perfectly plane surfaces, especially when bounded by angles, look somewhat concave. I conceived that the flat faces of my obelisk in its first stage did so, and yearned for this correction. I supplied this at first by a convex entasis, or coming out on plan derived from a segment of a circle, for which, however, eventually I substituted one derived from the flat side of an ellipse. All the faces of this obelisk have thus, in addition to the lateral entasis, an elliptical entasis on plan of very delicate sagitta all the way up. As therefore this treatment runs from the base of the shaft to the apex it adds a slight upward arch to the base of the pyramidion, and to all transverse lines which might be put in the way of inscription on the shaft. This entasis on plan has been acknowledged, and I think I may say is recognised, as an improvement to the obelisk. And the question naturally occurs, might not this treatment have its advantages in subjects of more extension? as it not only gives a certain fullness and fluency to the surfaces, but gifts all transverse lines above the eye with the compensation of delicate entasis, even while the beds of structure remain actually flat. It is chiefly when transverse lines are long, and subtend a large angle to the eye, that they most appear to droop in the centre. When, therefore, the front of a portico is far off, these transverse lines do not require so much compensation as when near. Entasis on plan meets this point, as when at a distance, and the line of vision is but little raised, the compensation thus supplied sinks to an almost inappreciable quantity, but as you approach the compensation increases. There appears to me a peculiar quality of welcome in the idea of these lines of architecture rising as you approach, and arching up as it were at last to let you enter. On the other hand, with the front flat on plan, and the transverse lines actually arched, as hitherto practised, they remain of course equally arched whether you are near or far. Of course, however, it would be requisite in execution to consider its effect in going out of a building. I would merely repeat that entasis on plan, while it leaves the beds of structure flat, which is convenient in building, affords the compensation of a delicate entasis increasing as you approach. The requirements of explaining my views in the smallest compass will, I hope, excuse any apparent advocacy of my method over the other. The best thing I can say to modify this is to add that I have used both methods conjoined in my trials on the obelisk, of which I shall speak presently. I merely desire to avail myself of this opportunity to broach the subject of entasis on plan, which, if it be thought worthy of being reduced to practise, might be supplied according as found most suitable to the various cases, either by the ellipse, the parabola, the conchoid, or a circle of very extended radius, or by the catenary stretching of the mason's line according to Mr. Jopling's method, or by other curves.

A Slight Historic Sketch of Obelisks.

Having now occupied some time in these remarks on the curvilinear treatment of surfaces, I will, if you please, before I begin to illustrate my own views as to their application to the obelisk, vary my paper by some account of the ancient history and existing examples of that remarkable unit of architecture.

In the primitive state of the world nothing was more ready as a record of an event than to set up a stone in the place in which it occurred. Thus, as the Bible informs us, did Jacob set up in Bethel the stone which had been his pillow, in record of his dream and the promise made to him, and the vision on that spot. "And Jacob rose up early in the morning, and took the stone that had been his pillow and set it up for a pillar." Subsequently, it is supposed from this type, these consecrated stones were not unfrequently called baituloi, or beitile, from Bethel. There is also another word which occurs in the Hebrew of the Bible, "Matsebah," which is in some instances translated "pillar," and at others "image," when it is apt to be thought to indicate a human figure. It appears, however, rather to have been used to indicate a high stone or obelisk. Selden, in his "De Jure Gentium," says, "nor while the word 'Matsebah' is translated "statue" does it signify what statue ordinarily does, *i.e.*, the human figure." Spencer also agrees that it indicated a column or a huge stone, rather than a human figure. Sanchoniathon states that the Phœnicians, and afterwards the Egyptians, consecrated columns to those who benefited mankind, and to the elements. Clement of Alexandria, quoting an old author, says that the Delphic Apollo was originally a column, and on the old coins of Apollonia that deity is recognised by the representation of an obelisk little different from those of Egypt. The reverence for the sun indeed, one of the purest forms of early profane worship, seems to have been often connected with the erection of the obelisk, which, from its being pointed at the top and increasing at the base, bears the general form of a ray of light (coming towards us), of which, according to some old authors, the obelisk was intended to be expressly a representation. Mr. Bonomi considers that the image of gold set up by Nebuchadnezzar, on the plain of Dura, to have been by no means the statue of a man, but a gilt obelisk. It was at the commencement of the 3rd chapter of Daniel that the words occur, "Nebuchadnezzar the king made an image of gold. The height of it was three score cubits, and the breadth thereof six cubits. He set it up in the plain of Dura, in the province of Babylon." Thus, as regards the proportions of this image, the height was ten times that of the breadth, which it is evident is wholly inconsistent with any proportions of the human frame. On the other hand it agrees closely with those of the more graceful Egyptian obelisks, of which the whole height is usually about ten times that of the side of the base. Mr. Bonomi, therefore, appears to be well borne out in his view that this image of gold, set up by Nebuchadnezzar, was not a statue of a man, but, in fact, an obelisk, gilt. It may also suggest itself that the worshipping commanded by the king was in some sort connected with the worship of the sun, of which fire was the worshipped type, as it was also a "fiery furnace," to which those were condemned who would not fall down before this great "ray of light." This, of course, was the abuse of a fine feature of architecture, no unusual occurrence, as even the most beautiful temples of the ancients were raised, not unfrequently, to deities of the most atrocious character.

The obelisk of the most extraordinary proportions of which ancient writings give us any record, was that of Queen Semiramis—which is thus described by Diodorus Siculus:—"Semiramis likewise caused a great stone to be cut out of the mountains of Armenia 125 feet in length and five in breadth and thickness" (so that it was twenty-five times as long as it was broad and thick). "This," Diodorus continues, "she had conveyed to the river by the help of many yokes of oxen and asses, and there put it on board ship and brought it safe by water to Babylon, and set it up in the most remarkable highway of that city, as a wonderful spectacle to all beholders. From its shape it is called an obelisk (obelos in Greek, signifying a spit), and it is accounted one of the seven wonders of the world." If this account of its proportions be correct, I cannot conceive it could have been beautiful, although it certainly was a wonder. It must have been secured in its erect position, I suppose, by being sunk in a socket, which treatment is applied to the Egyptian obelisks, but solely to the degree of preventing their shifting on their bases. Obelisks appear to have been as widely adopted as they are a simple feature in architecture. Indeed, they seem a form which is the common heritage of man, closely suggested also by nature, as for instance, by the Needles in the Isle of Wight. As the pyramid is a kind of scarped mountain, so is an obelisk a splinter of rock fashioned on four sides, and from its monolithic nature, more lasting than even the pyramid itself. In Maurice's Indian Antiquities, a sacred stone of this character is described by Captain Hamilton as existing in the Temple of Juggernauth. In the British Museum there is an Assyrian example, truncated, from Nimroud, in black marble, used, by means of relievi, as a record of events. As a feature of Art, the growth of the obelisk is evidently after this fashion. It first appears as a rude solitary stone, set up on end, of a long form, like the pillar of Jacob at Bethel. Then, gradually as the arts advanced, these features were fashioned and inscribed so as to become what Strabo emphatically calls them, "Books of History," the legitimate use of the obelisk surface being for inscription. Their use as such enduring and dignified records appears by no means, however, to have been confined to Egypt, as Sanchoniathon expressly tells us they were erected in Phœnicia prior to their adoption in Egypt. Yet it appears that it was in the latter country that they were most developed, the granite on the banks of the Nile lending itself so aptly to this purpose. Having thus indicated the extreme antiquity of these features of art as symbols, and as records of great historic events, we will proceed to some consideration of the best examples of these which remain to us, and will turn first to those of Egypt, which were transported to Rome by the Cæsars, and which still, after the lapse of so many centuries, and under its total change of dynasty and religion, still exist among the most striking decorations of that great city.

The Egyptian Obelisks in Europe.

I will preface, however, what I have to say of the Egyptian obelisks in Rome, by a list of those contained in Europe. In the British Isles we have four, but they are all small. The largest is at Corfe Castle, and does not exceed 22 feet in height. There is one at Alnwick, the seat of the Duke of Northumberland, and two smaller ones, truncated, in the British Museum, of black basalt. In France there is one at Arles and another in Paris, which most of my audience have probably seen, where it forms the centre decoration of the Place de la Concorde. In Florence there are two, in Constantinople two, and in Rome twelve. Thus, altogether, there are in Europe erect, 22 of these features of Egyptian art, which have been transported from time to time, with great care and attention, from their native land. Those in Rome are, for the most part, important in size as well as number. Also they were the first removed from Egypt, the Emperors of Rome appearing to have had a perfect passion for Egyptian obelisks.

The largest obelisk now existing in the world, is that called the "Lateran," from its situation in front of the Lateran Basilica in Rome. This splendid obelisk, originally, as it appears, 105 feet high, in one block, was, in the first instance, erected at Thebes, in Upper Egypt, in the propylœum of the Temple of Ammon Ra. Pliny says, this took place during the reign of Rhamses, King of Egypt, during the Trojan war, *i.e.*, nearly 1200 B.C. But obelisk readers discover on it also the name of Thothmes III. or IV., the 5th King of the 18th dynasty, who is the same as the Mœris of the Greeks, so celebrated for the formation of the great lake which took his name. Ungarelli assigns to it an antiquity of 1740 years B.C., and it now stands in the Lateran at Rome, a sufficient proof of the lasting nature of these records, having lived, as Mr. Burgess remarks, through the ruin both of

Ancient Egypt and Ancient Rome. Pliny, who tells the tale of its being first set up in Thebes by the King of Egypt, thus narrates:—"When it was on the point of being elevated, the king, being apprehensive that the machinery employed might not prove strong enough for the weight, with the view of increasing the peril that might be entailed by due want of precaution on the part of the workmen, had his own son fastened to the summit, in order that the safety of the prince might, at the same time, ensure that of the mass of stone." This probably is but an old tale, yet it points to the value and importance which was attached to these monolithic monuments in old times, and the degree to which they were cherished. The same author further narrates, that "it was in admiration of this work that, when King Cambyses took the city by storm, and the conflagration had already reached the very foot of the obelisk, that he ordered the fire to be extinguished; he entertaining a respect for this stupendous work which he had not entertained for the city itself. After remaining for more than 2,000 years on its original site it was floated down the Nile by Constantine to Alexandria, that Emperor intending it to embellish his new city on the Bosphorus. His death however occurring before this was accomplished, his son Constantius preferred to have it conveyed to Rome. In a vessel provided with 300 oars he caused it to be brought to Ostia, and thence up the Tiber to the Vicus Alexandri, a small landing-place about three miles below Rome. From this place it was dragged slowly, on low-wheeled waggons, to the Circus Maximus, on the spina of which it was set up A.D. 357. Of the time when it fell from its base we have no record. In 1588 it was discovered lying interred to a depth of nearly twenty feet, and broken into three pieces. It was re-erected in its present site, near the Lateran Basilica, by the celebrated architect Fontana, at the orders of the energetic Pope Sextus V. On the wall is a sketch of it as restored and decorated at the top, in a manner, however, which anything but improves it, for I quite agree with the Rev. Mr. Burgess that whatever may be done in the way of basing these monoliths, the apices and pyramidions should never be tampered with, as it destroys their upwardness and mars the whole feature. The pedestal on which it stands is of red granite.

I have hitherto been quoting from Mr. Burgess. I now quote from M. Bonomi. In this gentleman's notes on obelisks, he says:—"Having the opportunity of mounting on the top of the pedestal (in the winter of 1838-9), I found, by taking the dimensions of the lower part in a horizontal line, that it measured 12 palms 6 onci on two sides, and on the two other sides 12 palms 10 onci;" the sides thus being dissimilar in breadth, as is the case with Cleopatra's needle and some other examples. When it was re-erected, from the necessity of cutting the base so as to make it secure, and in the joining of it, it having been broken into three pieces, it appears to have lost somewhat of its length. At present it measures, as it stands with its pedestal and cross, 145 feet from the ground. It is supposed to have weighed not far short of 450 tons. It is covered on all four sides with hieroglyphic characters, in which the various titles of the King (Thothmes) are recorded. Thus, he is spoken of as "Lord of the upper and lower regions, and pleasant in his kingdom as the sun in heaven," and other loyal expressions. The religious feeling also, however, of the Egyptians is evinced by this same King being represented at the top of the obelisk as kneeling before Ammon, and presenting him with two cups, while the god in return holds out to him the symbol of life. Over the god is written, in hieroglyphics, "The bestower of perfect life, fortitude, and all goodness, Ammon Ra, lord of thrones;" and on the same obelisk the god Horus is mentioned as "Horus resplendent, the distributor of dominions and guardian of the double watch, &c."

The next example of the Egyptian obelisk in Rome, in point of size, is that which now stands in the centre of the Piazza San Pietro, in front of St. Peter's. This is, according to Mr. Bonomi, 83 feet 2 inches in height. It was brought from Heliopolis, in Egypt, to ornament the circus afterwards called that of Nero. "The main interest however attached to this obelisk," Mr. Burgess says, "arises from its being the subject of the first experiments of setting up a fallen obelisk in modern times, and from its being in one unbroken mass, weighing 331 tons. During its erection, the Pope had given orders that no one should speak above a whisper, especially during the last moments of its attaining an upright position. It appears, however, that something was in fault, and the machinery was "chock and block" before it was quite up. The workmen could haul no more, and there it hung not yet erect. A well-known story goes that at this breathless 'crisis' an English sailor, in defiance of the order of the Pope, broke the silence with the words, "wet the ropes," which being done, they contracted just enough to set up the huge monolith erect in its place. Our tar, however, has a rival in this claim, as the Romans attribute this opportune but bold advice to one of their own country, a member of the Bresca family of San Remo. "There is" indeed, Mr. Burgess informs us, "an old picture in the Vatican, which represents the man in the act of being seized by the guard. He was taken before the Pope to be condemned, when, however, instead of confirming the threatened punishment, Sixtus told him to name his reward. To which the bold adviser replied by suggesting the privilege of supplying the palm branches to the Sistine chapel, and his descendants still claim the monopoly." This obelisk was thus re-erected in 1586. It was originally brought to Rome from Egypt, in the reign of Caligula, by whose orders probably also it was cut, as there are no characters on it, while the Egyptians, on the other hand, in their own works of this kind universally used them for inscription, as open books. With its base and ornaments, as it now stands in the front of St. Peter's, as a centre decoration of the piazza, it measures, from the ground to the apex, 127 feet 6 inches. It also serves as the gnomon of a monster dial, traced on the pavement by Pietro Maccarini. Besides these two noble examples of the obelisk in Rome, there is the Flaminan obelisk, in the Piazza del Popolo, a genuine Pharoanic example. The Campensis obelisk, on the Monte Citorio, which so charmed Wilkelman with the beauty of its hieroglyphics, and the Pamphilian obelisk, in the Piazza Navona, associated with a fountain. There are also the Trinità del Monte and Aurelian obelisks, and five others, none of which however are very large. I present a few sketches of some of the above mentioned. This list, however, falls far short of the number of obelisks mentioned in the catalogue compiled by Publius Victor, in the time of Valentinian and Valens, A.D. 364, as having been then erect in Rome. In this public record he mentions 48 obelisks. The places of some of the missing ones are suspected, but there are still more than 30 to be accounted for.

Of the two obelisks in Constantinople, one is of very broad proportions.

The well-known example in Paris is somewhat irregular in execution, being also slightly bent. Its height is 76 feet 6 inches. It is still a monolith, being unbroken. It was originally set up in Luxor, by Rhamses II. Its weight is not far short of 300 tons, and its mode of re-erection, in its present site, is recorded in diagrams on the base on which it stands. The Egyptians, however, according to Herodotus, moved a monolith temple 600 miles, which Mr. Burgess calculates as weighing not less than 5,000 tons, or about 18 times the weight of the Paris obelisk—but no record remains of how this was done.

EGYPTIAN OBELISKS IN EGYPT.

I will now just give a catalogue of those obelisks which still remain in Egypt. The principal of these is that which still stands erect at Karnak. It is only second in height to that of the Lateran, being 93 feet 6in. from base to apex. It is an obelisk of the time of Thothmes I. Its proportions are slender, even too slender according to the impression of some. It has, however, stood now between 3,000 and 4,000 years, which is some proof of permanence. Contrasted with these proportions are those of Cleopatra's needle at Alexandria, which is an obelisk of the time of Thothmes III. This is 69 feet in height. Its proportions are much wider than those of Karnak. Perhaps these two well-known examples may be taken to represent the opposite limits between the massive and the taper of graceful proportions in obelisks. The proportions I have chosen for mine are between the two. Besides these, there are six other obelisks of large size erect in Egypt, more or less broken. Besides these, there are prostrate 12 more, all Pharoanaic; and in the quarries of Assuan, at the first cateract, there is one partly wrought. Egypt, however, has, as you have seen, been largely despoiled of her remarkable and enduring monoliths, and at one time there were grounds for fearing that she might be left almost without an example of this characteristic. We, in Britain, at least now have no excuse for extending this spoliation, as we have discovered that we have granite in this country which would yield, if required, even a larger monolith than that of the Lateran. Mr. Bonomi, speaking generally of obelisks, says, "These monuments of Egypt may be described as long quadrilateral stones, diminishing from the base upwards, till within about one-tenth of the whole height. The monolith obelisk of British granite, which I proposed as a memorial of the Great Exhibition, in connection with a Public Drinking Fountain, does not vary much from these proportions. The shaft was suggested to receive on it the many names of the various nations who contributed on the occasion of 1851. Colonel Hamilton, of the Guards, had a somewhat similar idea. If firmly based, there are no elements of decay in a monolith obelisk, and in regard to such a one as a memorial of the Exhibition of 1851, Mr. Robert Hunt suggested to me that if the New Zealander, with whose visit Lord Macaulay threatens us 3,000 years hence to see the ruins of St. Paul's, does really substantiate that prediction, he might well, as far as analogy teaches us of the duration of obelisks, thus find one relic at least of the present time still erect and unfaded.

The Obelisk of Definite Proportions and Entasis.

Up to this, with the exception of the suggestion of entasis on *plan*, what I have put before you has been greatly composed of the words of others, chiefly of those of the late Mr. Legrew, the Rev. Richard Burgess and Mr. Bonomi. I now, however, come to a portion of my theme in which I am unavoidably obliged to recount my own doings in regard to the addition of definite proportions and entasis to the obelisk. I do not set this forth as an isolated example, but merely as an illustration of a principle, as I have already shown. However, I shall not attempt on the present occasion to apply this to any further feature of architecture, but will confine myself to an account of how my obelisk came to be associated with definite proportions, and the curves of the conic sections, and this merely as an abstract question, though also I am obliged to go into some details.

My attention was called to the subject of obelisks some years ago, by my having selected this feature as the principal one in a design I made, at that time wholly privately for myself, for a memorial of the Great Exhibition of 1851. In consequence of this, and in looking at two or three other obelisks, especially those models of Egyptian obelisks presented to the British Museum by Mr. Bonomi, it appeared to me that what I described at the outset of the paper strongly attached to them, viz; that there was an apparent weakness and insufficiency in their form, and that their sides looked concave. I at first attempted to remedy this defect, by contracting the shaft at the top, by sloping the sides more, still however, keeping those sides straight. But this did not answer. The proportions of the obelisk were marred thereby, and the apparent concavity was but little, if at all, obviated. On this I determined to put in practice an idea which had been floating in my mind for some time; that was to add entasis to the sides, analogous to what the Greeks did to their columns. For this purpose I had a cast of my little obelisk split down the centre of the four sides, and opened out at the top somewhat more than the due proportion, so as to allow for rounding the sides upwardly a little, the divisions being filled up level with plaster. I then rounded the sides with a gradual but almost imperceptible entasis upwardly, until I had done away with the look of concavity. I did this with rasp and sand-paper until I had satisfied my eye, and I confess the result pleased me. This was the first step. When however I had done this, I conceived the surfaces to look somewhat concave horizontally on plan; and, that I might obviate this, I determined to make these slightly convex horizontally, by a segment of a circle bowing outward. For this line, however, eventually, I substituted a segment of the flat side of an ellipse, as more suitable for an obelisk, and for the purposes of inscription. I then curved the top transverse lines and surfaces of the pyramidion and so on, until not a straight line was left on obelisk on base. These were all however of very delicate entasis, only compensatory, and in execution, from the scale and material of my model necessarily incomplete. About this time I had taken the opportunity of setting forth somewhat prominently a proposal that the principal feature of the memorial of the Exhibition of 1851 should be a polished monolith obelisk, of British granite, with all the names of the countries that contributed inscribed on it, combined with a public drinking fountain, to be placed in the centre of the site of the Exhibition in Hyde-park, suggesting in this case the introduction on the obelisk of entasis. In consequence of this, I was invited by the Royal Institute of British Architects to lay my views before them of the principle of the entasis applied to the obelisk. This I had the honour of doing in May last, now just a year ago. At the commencement of that evening a most interesting paper was read by the Rev. Mr. Burgess, "On the Egyptian Obelisks in Rome, and Monoliths as Ornaments in Great Cities," in which he recommended their adoption here. This introduced my paper, from which, if you please, I will read two or three extracts. I said "that it had for some time occurred to me that had the Greeks adopted the obelisk, as they did various other component parts of architecture from the Egyptians, as it is said, that there was a probability that they would have modified it in some degree, as they had done in regard to columns for instance." I added, "that I believed I was correct in saying that in whatever the Greeks adopted from other nations they made modifications, making it thus, as it were, their own, and that in passing through their hands the rough-hewn ideas of their neighbours became, not unfrequently, refined to a degree of perfection which later times have been able to do little more than repeat. If, then, the Greeks had adopted the obelisk, I suggested, would they have left it as they received it from the Egyptians? I fancy not."

I went on to remark that "the tomb of Beni Hassan, in Egypt, presented pillars which, on account of the remarkable similarity between them and those of the Greek Doric order, had received the name of "Proto-doric." These Egyptian pillars, however, are destitute of entasis, which the Greek Doric examples possess on scientific principles. In some, however, of the other examples of Egyptian columns the shafts contract boldly also at the base, but still I said I believed that there was nothing like a scientific compensatory entasis analogous to the Greek in principle to be found in any of these cases. I expressed then my desire, feeling that I was then, in addressing the Institute, before the best architectural authorities, "to be corrected if I was in error in my supposition that thus the scientific compensatory application of the entasis to architecture generally, so as to satisfy the eye thoroughly, was reserved for the Greeks to arrange on just principles and to carry out with exactitude and beauty." I then went on to detail the making of my sketch model, which I have already narrated, and how in it the mission of entasis did not appear to end while a single straight line remained on the obelisk, nor the eye to be satisfied until every portion was clothed with these delicate curves, and in this respect I remarked on the yearning which a straight-sided obelisk appears to always express for these compensatory adjustments. Desiring also to test before such authorities whether I had been anticipated in my views and experiments, I invited information on that point. In the discussion which followed, Mr. Bonomi said, that when Mr. Angell and himself were in Rome together, that Mr. Angell had suggested the erection of scaffolding to measure the obelisks, with a view to ascertain if they had any entasis. But this idea was not carried out. Mr. Tite however, expressly stated that the straight sides of the Egyptian obelisks in Rome appeared to him to possess the insufficiency known to attach to perfectly straight treatment. Mr. Bonomi and Mr. Poole, both residents for a considerable time in Egypt, tell me that they have never detected any entasis on the examples in that country; nor does Sir Gardner Wilkinson, nor any other authority, as far as I know, allude to it. The tracings which I have here of some of the finest obelisks in Egypt are from careful figures in the great French work on Egypt, of the time of Napoleon I., and no trace of entasis is discoverable on them. Also if, as has been supposed, these features of art were in early times symbols of the rays of the sun, this does not favour the idea of any entasis having been applied to them, as assuredly a ray of the sun has no entasis.

Evolution of Definite Proportions in the Obelisk.

As regards my own attempt at a solution of this problem of applying curvilinear treatment to the obelisk, I have now brought you up to my progress in May last, when, as I informed the Institute of British Architects, I had only made a little sketch on the principles I spoke of without going into the refinements of detail for which the scale of this was not adapted. Circumstances, however, have since called on me to make a larger model not far short of 20 feet high, which has afforded me the opportunity of carrying the whole problem considerably beyond the point at which it then rested.

In my first little model I had adjusted its proportions and lines solely by my eye, and executed them actually by what in homely phrase is called the "rule of thumb." Now, however, that I had to have an enlarged and completed one executed by workmen, I had, of course, to furnish them with definite proportions to work by. I went to work therefore, for the first time, with my compasses, to seek out in my little model what definite proportions it really contained. I must premise that I had previously told my assistants that I thought the pyramidion a hair's-breadth too short. I added this slight increase in the working drawing, which is here. But it is so very small a correction as to be quite unappreciable, except on close inspection; and in an obelisk of a hundred feet it would not be above an inch. This is the sole variation between the original little model and the working drawing, which, however, I have preferred to place before you, as it is more easy to measure on, and as it shows the ground plan of each member. But to my process. I thus for the first time began to measure my little model to find out what definite proportions it possessed, when the following coincidences came out, one after another, quite unexpectedly, between what I had done merely by the eye and a consistent code of definite geometric proportions. In the first place I found, with my compasses, that the diagonal of the base of the pyramidion was exactly equal to the side of the base of the obelisk. This was the first step, viz., that the diagonal of the base of the pyramidion was equal to the side of the base of the obelisk. In searching further I found also that this gave the exact vertical height of the pyramidion itself. So here was a treble coincidence, of the most simple and definite nature. Firstly, that the diagonal of the base of the pyramidion. Secondly, that the side of the base of the obelisk; and Thirdly, that the vertical height of the pyramidion, should be all one and the same measure. Encouraged by this, I hoped that on applying this fortunate unit of measurement to the whole height of the obelisk, that I might be so favoured again as to find that it formed some aliquot part of this. But, no, it would not fit any way, either to the lateral or vertical measurement of shaft or whole obelisk. The measurement broke down altogether, and I was at fault. Having, however, found already that the diagonal of the pyramidion gave the side of the base of the obelisk, it soon occurred to me to try the diagonal of that base (that of the obelisk itself), which though growing out of the other, was a new measurement; and, having taken this, I began with my compasses walking up the vertical height of my obelisk, 1, 2, 3, 4, 5, 6, 7, when, to my surprise, and, perhaps you will smile when I add, to my great satisfaction, I found that I had landed with the seventh stride of the diagonal of the base exactly at the apex! Thus, seven times the diagonal of the base of the obelisk was the exact measurement of the vertical height of the obelisk. So here were all the general proportions of my obelisk exactly defined by one simple code of exact geometric proportions, of which the pyramidion was the key and pivot, and this arose quite unexpectedly out of a little obelisk which had been adjusted solely by the eye. More than one of those who assist me in my studio are here to-night, who witnessed the progress of my obelisk. They know I have not, in the least, "cooked my account." I dare say no one will suspect me of not being quite open, but it is pleasant to have proof at hand if required. The original little model also is in my studio at Kensington, and I shall be most happy to show it there to anyone who may take interest in the problem. As regards the number 7, as it is an element of so many things of great import, and characterised, as it is, as "the perfect number," I own it was a satisfaction that it should be that one which came in of itself to complete the code of definite proportions. In the Parthenon, the proportions have been stated by Mr. Penrose to all bear relation one to another, and to be composed of mutual aliquot parts, and Mr. Jopling has carried this still further. He has published a measure which he calls the pivot, and which is the difference between the diameters of the top and base of the shaft of one of the columns of the Parthenon, and which is also derived geometrically from the inscribed square of the top of the shaft. Seventy-two of these measurements give the breadth of the Parthenon, and 162 its length, and 10 of the same measurements the space between centre and centre of the columns. In like manner all the proportions of my obelisk possess a direct geometric relation. Taking a base of a cone of which the vertical height is equal to its diameter, the inscribed square is the base of the pyramidion, and the circumscribed square the base of the obelisk, and so on. An agreeable presentation arises from this, for you have only to strip a cone of this proportion, (viz., one of which the vertical height is equal to the diameter), from the apex down to the incribed square at the base, when you discover a pyramidion of the exact proportions of that of the obelisk, which is in turn the key to all the other proportions of the obelisk.

Application of the Conic Sections, as Entases, to the Obelisk.

This application of the cone to the pyramidion will serve to introduce the second portion of my treatment of the obelisk, that of applying the conic sections to clothe it with its various entases. You know the simple conic sections are of five different characters. Firstly, there is the rectilinear one through the apex, of which a side of the pyramidion is an example. Secondly, the circular, cutting the cone in a plane at right angles with the axis. Thirdly, the ellipse, cutting the cone across, but not at a right angle, but slanting as it were. Fourthly, the parabola, which is a section parallel to the side of the cone, and which would never cut the cone, however much produced; and fifthly, the hyperbola, which, from its direction further approaching that of the axis still wider, avoids cutting the cone across. Lines derived from each and all of these qualities of section come in to complete the obelisk and base, and to endue with a compensatory fulness the cone produced by the definite proportions. I will not go now into the details of the mode of obtaining the hyperbolic line, which I adopted to give the lateral entasis of my obelisk, as it would occupy too much time. I would only say that my assistant on this occasion considered it should be struck from a point on a level with the base of the obelisk. I thought this would give too much entasis, as it proved eventually, and I therefore desired him to strike the entasis from a point on a level with two diagonals of the base below the base, as in the case of the columns of the Parthenon, when another very curious and unexpected coincidence came out, viz., that I had, without knowing it, and only to please my eye, made the base on which I had placed my obelisk exactly these two diagonals in depth. So that the entasis was eventually struck from the ground line of the basement, as is the case with that of the Parthenon columns. There appears a principle in this, and the entasis thus obtained for the obelisk (by Vignola's method with a minute correction) came out quite satisfactory, being just compensatory and no more. The sagitta of this curve is little more than an inch on the elevation in an obelisk of 77 feet 9 inches in height, being however of course somewhat more on the angle. This entasis is less than the entasis on the columns of the Parthenon, but somewhat more than that on those of the Erectheum. The elliptical entasis on plan, which I adopted for the surfaces of the obelisk has a sagitta of one-third of this. This entasis on the horizontal plane runs over the top of the shaft, and only vanishes at the apex. Thus all the eight surfaces are curved with lines derived from conic sections. The same treatment, in conjunction with lines derived from the parabola, is also applied to the bases which support the obelisk; and lastly, the circle, as the base of the cone in the lower compartment of these, in conjunction with the square, forms in its one circumference the four basins of the Drinking Fountain. Thus the solution of this problem has been guided throughout by the conjoined working of all the five simple conic sections, together with the perfect number 7 and a code of definite geometric proportions, of which each bears a direct relation to every other.

Conclusion.

I will not go further into the minor details of this obelisk, although there are several other results of the same character which have evolved themselves naturally from its code. I would desire, however, to say that I should be very sorry to be thought to presume that the code I have adopted for my obelisk is the sole one to be applied to that feature of art. I am very far from thinking this, although, perhaps, I may conceive that some general points of value may be indicated by the adventures of my solution. Even, also, in regard to the conic sections, although I may myself think that these marvellous curves which regulate the paths of the heavenly bodies are also those which chiefly form the curves of the leaf, the petals of the flower, and the graceful contours of female form, yet I am delighted to acknowledge the charm of other natural curves as the conchoid, the cardioid, and the catenary, &c., as applicable to art. The view, indeed, which I take of the obelisk is that it is a feature of art yet undeveloped, and one which, as far as I can discover, is in the same state in which it was left by the Pharoahs. Also, that it is a feature highly suited to monumental record; and, therefore, from these two causes, offering a fine fresh field for invention, both in regard to general proportion and minor details. My own I have introduced as a humble illustration of the working together of the eye in accordance with geometric proportions. The illustration may be inadequate, but the general principle, few in these days, I conceive, will be found to ignore, viz., that Science and Art should work together. The Greeks have amply proved their adherence to this maxim, which I offer as the moral of my remarks to-night. I wish, however, to be understood that I by no means fancy that a work of art is to be built up by the Rule of Three. To hold that, would, in my idea, be pedantry. We have been endowed with direct perceptions of beauty, which we should be absurd to lay aside to take up, instead, logarithms or algebra, but as in some sort geometry is the essence of reason, so, rightly applied, it comes in, I believe, to give definition and satisfaction to all forms of art. "Nature" has been said "to work by geometry," and the more art can do the same without crippling her more direct and intuitive methods, the better, I fancy, will be the result. In the achievement of forms of beauty, therefore, I hold that the concurrence of definite geometric proportions may be of the greatest practical use in aiding the eye when once you are so fortunate as to discover that ratio of their code which is in harmony with the subject in hand. Then, also, you have something explicit for your assistants to transfer and work by, and science and art advance hand-in-hand to the result. In undertakings of this kind, the square and circle, mutually inscribed and circumscribed, appear to afford a code of great value, not only as applied to the Parthenon, as shown by Mr. Jopling, and to the obelisk, but also to the proportions of the human frame, as I hope, at some future time, to have the honour of laying before you.

In the progress of the special problem of the obelisk, which I have had the honour to-night of submitting to you as an illustration, I have only now the pleasant duty remaining of returning my best acknowledgments to many who have taken an interest in it. Especially, I desire to acknowledge the liberality of feeling extended to me by the architectural profession. Being a sculptor, and not an architect, and this specially an architectural question, not only have I had no check on that account, but I have received, on the contrary, nothing but assistance and encouragement from that profession. Mr. Angell, Mr. Bellamy, Mr. Bonomi, Mr. Tite, Mr. Donaldson and others, have given me especial encouragement, and I have had much assistance from the labours of Mr. Penrose, at Athens. I have however especially to acknowledge the direct assistance of Mr. Jopling, a gentleman who is well known as having made definite proportions and scientific curves his especial study. Although certainly the idea and scheme of my obelisk is my own, yet in evolving it the knowledge and suggestions of Mr. Jopling have been of the most direct practical assistance. Perhaps also, in conclusion, the best excuse that I, as a sculptor, can offer for my having taken up this subject at all, is to be found in a remark made by that gentleman (himself an architect) one day in my studio, when he said to me, "You sculptors have your minds and eyes so constantly directed to form that your training is especially adapted to educate your perception of proportions and curves."

DISCUSSION.

The Secretary read the following letter from Mr. Joseph Jopling, who says:—

As I cannot be present at the Society of Arts when Mr. Bell's paper is to be read, I have enclosed my "Key to Proportions of the Parthenon," and with this I send a copy of a letter to Mr. Tite,* on the arrangements of the surrounding columns of the "Mausoleum of Mausolus." For this I have received Mr. Tite's thanks.

During the last fortnight I have had some assistance at the British Museum, and have verified, from the remains of the Parthenon there, some most important facts.

I need only mention the exact height of the capital, viz., 2·8177 feet English.

This is exactly $\frac{1}{36}$ of Mason's line end upper step.
Ditto $\frac{1}{81}$ of Mason's line side upper step.

The number 36 is the number of divisions of 10° each in a circle.

$\sqrt{81} = 9 =$ number of divisions of 10° each in a quadrant.

$\sqrt{36} = 6 =$ number of divisions of a circle by radius.

I may just add that while calculations are necessary to prove the great accuracy of the Greek work and of Mr. Penrose's measurements, no measurements or calculations, so to speak, are required to design and set off work full size, on precise principles.

True results are obtained from principles with much less trouble, and with far greater accuracy, than by setting off any measurement from the most careful drawings, and with the most correctly divided scales, rollers, and rods.

This can be made manifest by setting out and drawing, full size, the plan of the column of the Parthenon, say of the east end upper step, with one or two return columns, and showing the direction of the inclination of the axis of each.

This, and very much more, can be done to illustrate the laws followed by the Greeks, without interfering with any object in that gallery of their antiquities.

At first this may be shown temporarily, to make manifest the facts. After complete conviction, no doubt a more permanent record of such laws will be deemed necessary to arrange every department of art, to study and make application of principles on principles—eternal laws of forms and proportions.

Mr. J. SCOTT RUSSELL, F.R.S., on being called upon by the Chairman, said he was sure they must all agree with him in hoping that the obelisk proposed by Mr. Bell as a memorial of the Exhibition of 1851, would be erected of a durable material, and on the proper site, so that they might judge upon a large scale of the effect of the realisation of Mr. Bell's proposition. He thought Mr. Bell had thrown out some valuable observations of a general nature in reference to architecture, which showed that architects and sculptors were beginning to unite and take broader views of their art. It was very satisfactory to see that two points, definite geometric proportions, and entases of delicate curves, which had been fancied to be only crotchets, suitable to the brains of an enthusiast, had been practically reconciled by being brought to the test of artistic feeling and scientific experiment. He thought it was a most important fact that Mr. Bell had felt his way to the production of such a form in this feature of art as should be perfectly pleasing to the eye, before he arrived at his theory, and that he derived this geometric theory of proportion from the actual model he had previously made. With regard to the particular proportions which Mr. Bell had found to rule in his obelisk, he (Mr. Russell) was very much pleased that they did so; for he had a notion that they ruled many other things besides. It was now proved that an object of true proportions could be appreciated by the artistic eye alone, unassisted by mathematical reasoning, and the perfect reconciliation of the two was the true basis of art; and was the basis from which he could not but hope we might cease to *imitate* in art, and begin to *create*. Now it simply came to this, when one was making choice of proportions in which considerations of utility did not enter, one was left to choose proportions which had nothing to control them but either pure reason, or, he would call it, pure instinct. Now this was quite certain, that in almost everything in which there was a choice, it was more pleasing to the mind to choose definite and exact proportions than to take indefinite and chance proportions. There was no

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* (COPY OF LETTER REFERRED TO.)

6, Vassall-terrace, Kensington, W., 25th Nov., 1858.

DEAR SIR,—Your most able paper on "The History, Discovery, and Remains of the Mausoleum at Halicarnassus," has directed my attention to figures and statements, to try if I could discover any law by which that monument may have been proportioned.

Without now explaining how, it may be sufficient at present to state that I have ascertained that with no more knowledge than—

3ft. 5in. as a diameter, and
7ft. 4in. as the space between columns,

or, 10ft. 9in. from centre to centre of columns,

the 36 columns of that mausoleum could not be arranged, on the surrounding plinth, of the dimensions 114 by 92, to appear as harmonious, on all sides, as the 46 columns in the Parthenon have been executed.

By what standard measure, or whether the dimensions of the mausoleum have been taken and recorded as accurately as those of the Parthenon by Mr. Penrose, is not stated.

The English foot is but a little less than the larger Greek foot and with less accuracy in the measure and the measurements than were used and made by Mr. Penrose, the results, as if measured by the true Greek foot, may have been gained, and thus account for the identity I am about to explain.

Previously to doing so, I beg to state that before the columns could be properly and harmoniously arranged, it was necessary that the distance from the edge of the plinth to the line of the centres of all the columns should be determined.

This distance I have found to be 2ft. 3in.

Then the measure 10ft. 9in., as stated, being made the distance from the centres of the rough columns to the centres of the second column, each way, allows exactly 11 feet for the distance from centre to centre of all the other columns, on all faces, thus :—

FOR A LONGER FACE.

ft.	in.		ft.	in.
2	3 by 2	... ...	4	6
10	9 by 2	... ...	21	6
11	0 by 8	... ...	88	0
	The length of the plinth given ...=		114	0

THEN, FOR A SHORTER FACE.

ft.	in.		ft.	in.
2	3 by 2	... ...	4	6
10	9 by 2	... .	21	6
11	0 by 6	... ...	66	0
	The other measure given of plinth		92	0

Is this not extraordinary accuracy?

But I have also found out the law, the process, by which the exact diameter stated was detetermined, and, I doubt not, the key to other proportions.

"Diameters" are not the first step, but results of a previous geometrical process.

Further, there is evidence that the proportions 3, 4, and 5, for setting off a right angle, were known to the architects of the mausoleum of Mausolus as well as of the Parthenon.

Again, in those marbles there is evidence of the knowledge of results of eternal laws applied in forms as well as in proportions; which, by systematic study, may be worked out and made as evident as the facts I have stated.

Surely further investigation into the precise principles of proportions and forms applied in the finest works of antiquity cannot be unworthy of the attention of a great nation, after so much time, labour, and cost, in procuring such objects of art.

I have the honour to be, dear Sir,
Your most obedient humble servant,
JOSEPH JOPLING.

William Tite, Esq., M.P.

The data for this letter were taken from the *Builder.* "Papers respecting the Excavations at Badium, presented to both Houses of Parliament by command of Her Majesty," I purchased 16th April, 1859, I now find contain further evidence of importance.

doubt whatever that the appreciation of exact and beautiful forms did increase and grow in one's mind by the knowledge of definite proportions. He thought the mind never perceived anything which it did not look for, but when to a work of art was brought a knowledge of definite proportions, then true appreciation followed, and it became possible to ascertain whether the artist knew more than the observer, or less. With the proportions clearly in the mind of the observer, he was able to discover them in a work of art, and without this he would not find them. He, therefore, said that a knowledge of definite, exact and reasonable form—form regulated by intelligible law, which could be carried in the mind—that was what the mind ought to bring to the judgment of Art, as well as to the creation of it. He was now about to make an observation, which he would guard them against misunderstanding. He was going to put, in rather an exaggerated form of words, what he thought was a very remarkable point involved in Mr. Bell's theory, and one well worthy of consideration. It was this—that the ordinary laws of perspective, as laid down in *the books*, were not the true laws of vision; the lines of perspective were in fact not straight lines; but he was prepared to show, by the most irresistible evidence, that they were slightly curvilinear. If a very large picture of a very large object were to be drawn, the straight line of perspective must be abandoned altogether. A very large object could not be represented in proper perspective to a human being of limited powers of vision by straight lines; for this reason—supposing one was in a long gallery, if one looked to one end of the gallery, the lines converged one way, and if one looked to the other end the lines converged in the opposite direction, and yet it was clear that these lines nowhere formed an angle with each other. What was the effect of that? Evidently that the lines were curved. Now the question was what kind of curve was this? It was simply the curve of the entasis, approximating infinitely near to a catenary or to a very flat hyperbola. He could not definitely say whether it was one or the other, but it was nearer to these curves than to the old-fashioned straight line. If this were true, the laws of actual vision were different from the laws of plane perspective; and then what Mr. Bell had said, necessary followed, because everything must be represented with this curve of entasis in order to appear to be in true perspective. He had never found this theory in any of the books, and he had ascertained from personal observation that the received laws of plane perspective were in this respect quite wrong. This law must, however, be taken with certain limits. What were these limits? They were, that practically, if one looked at a small portion of a side of a room, one did not require in the drawing of it any entasis, and if one went to a long distance, entasis was equally unnecessary; but if the object was a building, which was large in proportion to the human figure, and so near that the eye could not embrace it all, then entasis was necessary. Moreover, if this law of perspective was true, it would show that the entasis of columns, to be pleasing, must take its origin from the level of the eye. Therefore, talking of the entasis beginning at a point one-third up the column would be incorrect; and he had observed that if the plane from which the entasis of a column began was discovered, and the eye placed on a level with it, from that point the effect was perfect; but if the eye was not on a level with that point, the true effect of the entasis was lost. Therefore, the beauty of his friend Mr. Bell's obelisk was very much owing to the fact that the entasis began pretty near to the level of the eye. He doubted very much whether it would look as well if one looked down upon the obelisk from above.

Mr. BELL—When looked at from above it appeared exaggerated.

Mr. SCOTT RUSSELL—That was exactly what he should have expected; therefore he said the entasis, to be perfect, must spring as nearly as possible from the level of the eye. He would conclude his remarks by expressing a sincere hope that Mr. Bell would pursue his inquiries in this direction, and at a future time favour the Society with another paper upon this very interesting subject.

Mr. VARLEY remarked that the general principle of entasis had been very beautifully explained by Mr. Bell, who was an able and practical artist, and it was of universal application in architecture, but he must be allowed to express dissent from some of the remarks of Mr. Scott Russell, because he had left out of calculation one very important element. When they represented a building upon a flat surface, whatever way they looked at it they looked upon the same surface, and if there was entasis upon the building, it would be upon the paper. In his opinion the received laws were strictly true. There had, however, been a good deal of difference of opinion amongst artists upon this point. The application of definite proportions in this instance had very much delighted him. Mr. Bell had happily found his own artistic eye in harmony with geometrical rules; and he (Mr. Varley) attributed the rapid rise of the ancient Greeks to so high a degree of perfection in Art, to the fact that they acknowledged mathematics and geometry to be their masters, and they obeyed them.

Mr. SCOTT RUSSELL said he had distinctly stated that unless he guarded his expression with regard to perspective, he should be misunderstood. He meant to say that in a very limited scale, where the object could not be truly represented by a small piece of paper, the ordinary rules of perspective would be right; but when the eye embraced a view of (say) 180 degrees, they would see that all correct representation upon a flat surface, by the ordinary rues of perspective, ceased.

The CHAIRMAN said they were favoured with the presence of a gentleman whose name had frequently occurred in the paper as having rendered great service in the measurement and other details of monumental antiquity. He referred to Mr. Angell, who, he hoped would favour the meeting with some observations upon a subject with which he was so well acquainted.

Mr. ANGELL would merely remark that it was now upwards of a quarter of a century since he had had the advantage of examining the obelisks at Rome. His impression at that time was that there were no entases, and he had fancied, until he proved his mistake, that the ancients had made them concave on purpose; but he found them to consist of perfectly plane surfaces. The idea of introducing entasis on *plan* was very suggestive; and he was not certain whether it would not apply to exteriors for convexity, and to interiors for concavity. He was not prepared to advance anything upon that subject at present, but he thought it was one worthy of attention.

Mr. BELLAMY agreed with Mr. Bell that the artistic treatment of the obelisk had remained very much where the Pharaohs had left it, and that branch of art was in a very unsatisfactory state. In his own mind there was no question as to the value of entasis in the obelisk. Mr. Bell, in speaking of the various obelisks now in Europe, had omitted to mention the one at Ramsgate, erected in commemoration of the embarkation from that place of George the Fourth, upon a visit to his Hanoverian dominions. He had inspected that obelisk, and he had only to look at it for a moment to find that the sides, although perfect planes, presented an appearance of concavity which was unpleasant to the eye. If his mind had not been made up before, that inspection would have been conclusive to him. With respect to the entasis on plan in the obelisk, he thought Mr. Bell was perfectly right, but in his (Mr. Bellamy's) opinion, its application should be limited to small objects, such as the obelisk. For these it was invaluable, as it tended to correct the harshness which straight lines were sure to impart. Therefore as regarded the base, sides, and pyramidion of an obelisk, he thought that for assigning them that delicate sectional curvature, Mr. Bell was entitled to the thanks of the architectural profession. The Greeks assigned to their external columns a larger diameter than to the intermediate columns, because, as had been said by Vitruvius, there was a larger amount of air round them than round the intermediate ones: and it had been found, with reference to the excess of the diameter of the external columns in the Parthenon, that it was only one fiftieth of the diameter, so delicate was the perception which the Greeks had of the effects of visual error. When Mr. Penrose propounded his theory, of the horizontal curvature of the base and entablature of the Parthenon, it fell to his (Mr. Bellamy's) lot to combat that opinion; and although he knew the Parthenon was founded upon a rock, and therefore subsidence had no place in that building, yet he believed, looking at the fractional amount of curvature, it was owing to some slight irregularity of the masonry, rather than to any principle which guided the Greeks in introducing an entasis. Intending to be present that evening, he had paid a visit to the Royal Exchange—that great work of Mr. Tite. The stylobata there was broken up, and was not continuous; but there was a continuous entablature, and it was impossible to conceive anything more true or more agreeable to the eye, though it was bounded by right lines and consequently by right planes. If Mr. Tite had introduced there the curves of Greek architecture he (Mr. Bellamy) conceived it would have resulted in deformity. The only similar case in London which occurred to him was in the long line of the Royal Institution, in Albemarle-street, which also was straight. This brought him to the observations of Mr. Scott Russell, in reference to proportion, from whose views he ventured to differ. Let them look along a line of railway laid down as accurately as any right line could be laid, (and they found nothing which would better illustrate the laws of perspective,) and yet they found that the rails came to a point at the end of the range of vision. If Mr. Scott Russell was right in his views, the sides of a long gallery ought to be concave, in order that they might appear in right planes.

Mr. Scott Russell said, if what he had stated was right, all the lines on the level of the eye would appear perfectly straight, being in the plane of the eye. There would be no entasis in elevation at the point in the columns of the Parthenon on a level with the spectator's eye; therefore, Mr. Bellamy and he coincided thus far. But there would be entasis on the portions above and below. In the case of a railway, which he admitted to be a good illustration, if they cut off a certain distance it was perfectly straight, and converged in straight lines. But if they stood between the two rails, that which was convergent one way would, if they turned round, be convergent the other way.

Mr. Bellamy stated that this was, in fact, the looking at two distinct objects at two distinct times.

Mr. Scott Russell added that he thought Mr. Bell erred with regard to the entasis in the obelisk in this respect; that he considered it should originate at the base, whereas it should commence at a point on a level with the eye.

Mr. Bellamy would tender his thanks to Mr. Bell for the services he had rendered to the architectural profession; and the inquiry which had arisen out of Mr. Bell's proposal to erect this obelisk in commemoration of one of the greatest historical events in this country, would be of the utmost value. Mr. Bell had entered, *con amore*, into so many subjects connected with his art, that he had conferred a very great boon on art generally.

Mr. Robert Hunt, F.R.S., said, that passing from the study of the beautiful in form to the practical, he had a few remarks to make. Nothing could be more appropriate to mark the site of the Great Exhibition—one of the most important events of the present age—than an obelisk, such as that proposed by Mr. Bell, of granite, which, as that gentleman had said, would endure for ages. The question, however, arose of the possibility of obtaining a monolith in this country which should rival Cleopatra's Needle in size. Was it possible that any of our granite quarries could produce in one block, free from flaw, a stone 100 feet in length and ten or twelve feet square? Within the last twelve months he had been at some trouble to ascertain if such a stone could be obtained, and although there were many, and some serious, difficulties in the way, he was satisfied that such a stone could, from two if not from three places, be supplied to order. It was necessary that he should explain a few of the difficulties. The condition in which granite was found was not well understood, and many misstatements had been made. It was generally thought that the granite below followed the contour of the hill formed of it; this was not the case. The granite-hills consisted of a group of botryoidal masses. Each boss might be compared to an onion, which had been cut at right angles to its axis, and placed on its base. Here, and so in the granite, there was a series of concentric layers, varying in thickness; these divisions being known to the quarryman as the "bedway." These curved masses of granite were subject to a system of joints, this jointed structure evidently having some curious relation to the magnetic meridian. Now, a mass of granite must be obtained, the curve of which was sufficiently extended to give a straight piece of the required length, which should be between the bedways at least twelve feet thick, and free from joints. His enquiries and examination enabled him to state such a piece of stone could be obtained from the Cheesewring Quarries, near Liskeard, and from the Lemorna Quarries, near Penzance; and one huge boulder appeared to exist on Dartmoor, far exceeding the required size. With regard to the imperishable character of granite, he had only to refer to the upright stones of the Druidic Circles—the holed stones, evidently connected with the fire worship of the ancient Britains, through which the superstitious mother still drew her child, afflicted with rickets,—to the inscribed stones of Gulval and elsewhere—and the Cyclopean masonry of Castle Freryn, which had stood for thousands of years the beat of the Atlantic gales, without any evidence of decay—to prove that an obelisk of granite might endure for countless ages, to tell the story of the triumph of human industry.

Mr. Bellamy would ask Mr. Hunt's opinion whether a monolith 120 feet long and 14 feet on the sides, could be obtained from the Cheeswring granitic formations?

Mr. Hunt was satisfied that a monolith of 90 feet might be obtained in this country, but they must bear in mind the difficulty with regard to the jointed structure of the mass.

Mr. Bellamy said, of course his inquiry had reference to the perfect homogeneity of the mass. In the case of the Nelson monument in Trafalgar-square, Mr. Freeman, a gentleman well-known in connection with quarries, was consulted as to whether he could furnish a monolith 120 feet in length, and 14 feet on the sides. After sending down to Cornwall, Mr. Freeman reported that he could supply it, if they could find the means of bringing it through London and raising it up on end.

The Chairman said they had listened to a most able paper and interesting discussion, and without longer detaining the meeting, he begged to propose a vote of thanks to Mr. Bell for his valuable paper.

The vote of thanks was then passed to Mr. Bell.

The Secretary announced that this was the last Ordinary Meeting of the Session, and that the Annual General Meeting of the Society would, in accordance with the Bye-laws, be held on Wednesday, the 29th June, at 4 p.m.

WOODEN OR IRON SHIPS.

The following letter has been addressed to the editor of the *Times*:—

Sir,—For some time past so much attention has been directed to the large amounts expended in building and maintaining the ships of the navy, that it may not be considered uninteresting to bring forward some of the advantages of substituting iron for wood in the construction of ships for war purposes.

1. Ships built of iron are stronger, more durable, and less costly to keep in repair, than those built of wood.

2. Iron in any quantity, and of the exact scantling required, can be procured on short notice from the manufacturers in this country.

This will save the large outlay in timber and other materials which must now be kept in stock for seasoning, involving constant expenses, and occupying much valuable space in our dockyards.

3. On an emergency, iron vessels may be built at the dockyards or by contract more rapidly than wood vessels, and without the risk of decay which is always incurred by using unseasoned timber.

Iron lower masts and yards and wire standing rigging should also be substituted for wood mast and hemp rigging, as the former have been proved by many years' experience to be more durable and efficient, and at the same time less costly than the latter.

It is true that many parties still make the same objections that were urged 20 or 30 years ago, and say that iron ships are untried. They certainly are comparatively untried for war purposes, but it is well known that iron vessels built more than twenty years ago, after doing very hard service, are still in good order, and that the majority of private shipowners are giving up the building of wood ships and adopting iron.

The Peninsular and Oriental Steam Company abandoned the building of wood vessels many years ago, and the Royal Mail Company would have been much better off had they done so too, as they have lately had to condemn some of their wood vessels only a few years old, and have iron hulls constructed to receive the engines.

This subject becomes of more importance every day. The experiments made with the new form of guns and projectiles have proved that neither iron nor wood vessels as usually constructed, can withstand a broadside, and that to make them really efficient for war purposes they must be cased with thick armour plates, the weight of which is so great that it is practically impossible to apply them to a wood-built ship and at the same time insure the necessary strength, speed, and seagoing qualities.

The Admiralty have so far admitted the truth of this as to order one large iron screw-frigate of 6,000 tons, which, no doubt, will be followed by many more, as it is clear that one such vessel cannot be of much service for naval operations.

From an experience of 30 years in building and managing iron and wood vessels, I feel convinced that if the construction and re-construction (as it is now called) of wood vessels is persevered in, millions of money will be thrown away which might be saved by the immediate adoption of iron; and as no other country can compete with us in the construction of iron vessels, we shall be able, not only to maintain, but to increase the comparative superiority we have hitherto possessed over all other nations in naval warfare.

Requesting the favour of your inserting this letter,
I am, Sir,
Your obedient servant,
JOHN LAIRD.

Birkenhead Ironworks, Birkenhead, May 21.

Home Correspondence.

THE RELATIVE VALUE OF COKE AND COAL IN LOCOMOTIVE ENGINES.

Sir,—I observe in your report of the discussion on Mr. Fothergill's paper, on Thursday last, that my estimate of the addition of nearly one per cent. to the dividends on the original share capital of railways, which might be made by the general substitution of coal for coke at current prices, has been misunderstood. The estimate relates, as I have said, to the original capital only, not to the entire capital, which comprises upwards of 40 per cent. of preference stock and loans. Of course, a saving in working expenses would not directly benefit the holders of preference and loan stock, and it was for this reason that the estimate was framed in terms of the original capital alone.

I may further say, in rejoinder to Mr. Fothergill's statement at the meeting, that he must be in error in stating that the feed-water heating apparatus was not applied to the *Canute* during the first trials. I know it was on the engine during the whole series of his experiments, as well as during mine; indeed, he says in his paper that it was so. Moreover, there were precisely the same facilities for feeding the boiler with hot water at starting (by the common process of blowing back the waste steam into the tender) with one apparatus as with another, though he appears to claim a distinction in this respect in favour of the "modern" contrivance.

I am, &c.,
D. K. CLARK.

11, Adam-street, Adelphi, London,
May 21, 1852.

Sir,—I notice in the discussion of Mr. Fothergill's paper, in the last number of the *Journal*, that exception is taken by Mr. Bethell, Mr. Lowe, and Professor Wilson, to different statements in a report made by me to Mr. Fothergill, December 28th, 1855, and given at length in that gentleman's paper upon the chemical examination of the fuel used by the London and South-Western Railway Company in their locomotives; and as I was not present on the occasion to reply to these gentlemen, who were imputing just blame, if they were right, to Mr. Fothergill, instead of to myself, who made the chemical examination and report, will you therefore kindly grant me space for a few observations upon their remarks?

Mr. Bethell stated that, "with regard to the analyses before them, he confessed he was astonished at them, and he could hardly believe them to be correct." He further goes on to say, "they found it stated in the table before them that 1 lb. of Ramsay's coal evaporated 15 lbs. of water, whereas 1 lb. of coke evaporated only 12 lbs. of water. Again they found it stated that the Merthyr coal, which contained 89 per cent. of carbon and 4 per cent. of hydrogen, or 93 per cent. of heat-giving properties, evaporated only 14lbs. of water per lb. of coal, whilst Ramsay's coal, which contained only 90 per cent. of heat-giving properties, evaporated 15lbs. of water. That," continues Mr. Bethell, "to a theoretical man seemed an absurdity."

Mr. Lowe followed, and said, "he agreed with Mr. Bethell that there were anomalies in the tables before them, which were most perplexing. Some of these anomalies had been already referred to, and in one instance it was evident there was some mistake, viz., in the statement that there was more sulphur in the coke after it had undergone the carbonizing process than in coal itself. As gasmen they knew that when the gas was evolved from the coal a certain amount of lime was wanted to get rid of the sulphur which came out of the coal during the process, and therefore he thought there must be some error in the analyses before them."

Professor Wilson followed after Mr. Lowe, and said that, although not agreeing with either of the previous speakers as to the parts of the analysis and results they found fault with as being wrong—on the contrary, arguing that they were more probably not wrong—among other things stated that, "if Mr. Bethell would bear in mind the vast difference between the power of hydrogen and the power of carbon to generate heat, he would readily be able to reconcile the difference in the results obtained in the two cases (which he had quoted) which depended on the atomic proportions in which these two substances combined with oxygen." But Professor Wilson at the same time also said that "he could reconcile the difference in the relative quantities of sulphur in coal and coke, for when, as had been stated, it took 1½ tons of coal to make a ton of coke, it was possible that an extra amount of sulphur might exist in the coke, but he could not understand how coal containing 2 per cent. of ash could be converted into coke containing 7 per cent. of ash, when only 1½ parts of coal went to make 1 part of coke."

The very much larger amount of ash in the coke than in the coal from which it was made appears at first sight strange, but it did not escape my attention, as you will see, if you will turn to my report given in Mr. Fothergill's paper, page 461, of last week's *Journal*, wherein I state—"The next peculiarity to be noticed, between the coke and the coal from which it is made, is in the amount of ash being very much higher in the former than in the latter; this is caused by an excess of iron and silica principally, and were it not for the increase of ash there would not be so very much difference in their heating power, &c. I can only account for this increase in these two substances from their being volatilised in the coking ovens, and entering into the crevices of the fuel from which the gases escape."

"It is common to find large quantities of a hair-like substance adhering to the coke, varying in colour from a light-grey to black; this is silica, with a trace of carbon and iron, and which has been in a state of volatilisation till arrested by coming to a cooler part of the coking-oven, where it has condensed, and is found as I have described it."

These quotations from my report show that I was not ignorant of the ash appearing high in the coke, and that it was necessary, in some way, to account for it, and to show that those apparent anomalies, the excess of ash in the coke above what there apparently should be, and also the large amount of sulphur in the same, were the subject of consideration; and I further say, "that my experiments were repeated, and great care was bestowed to verify any results which appeared contrary to what should have been expected, such as the larger amount of ash in coke in comparison to the coal from which it was made; and the larger amount of sulphur in coke than coal, the general belief being that in the coking of coal most of the sulphur is driven off."

In regard to the sulphur, I also state in my report "that although in coking coal there may be a notable loss in the per centage of carbon, hydrogen, oxygen, and nitrogen in the coke, yet the sulphur has not only not decreased, but has actually increased in the per centage. I find in the coking-oven that not more than one-twelfth of the sulphur goes off from the coal, whilst the loss of the other gases is upwards of one-third of the whole."

"But portions of the coke may be found to contain a very much larger quantity of sulphur than I found in the above specimen, and if I had selected a piece from near the top of the column, instead of taking an average of the whole, I should have found much more than I did.

"The pieces of coke delivered to me by your assistant, which he told me he had taken from a quantity from the tender of an engine in going down to Southampton, on the 2nd ultimo, gave on an average 5·62 per cent. of sulphur, and some which I selected myself from the coke heap at the Nine Elms Station gave about 5 per cent."

Now, although I found only one-twelfth of the sulphur to go off from the coal whilst coking it, this would not interfere with Mr. Lowe's view that it is necessary for "gasmen," when making gas, to apply lime to get rid of the sulphur from the gas; for necessarily, by my showing, one-twelfth of the sulphur in the coal would be in the gas, and *should* be removed from it. What, then, is the quantity of sulphur remaining in the coke from which gas has been distilled? for I presume neither Mr. Lowe, nor any one else, will deny that there is sulphur in it? In my opinion this depends on the quantity of sulphur originally in the coal, and, to some extent, on the heat employed in distilling it; but even when high heats are employed in coking coal, I found it as I have stated, and have confirmed my results by repeated experiments.

I can only surmise, from the remarks of Mr. Bethell and Mr. Lowe upon the results deduced from my analysis of the fuel, that they were not aware of the fact that from the ultimate analysis of combustible bodies their relative values as heat-givers, producers, or generators, are calculated, and that many tables of the relative values of fuels have been constructed, based upon such calculations, for many of which tables I would refer them to the Chemical Technology, by Dr. Ronalds and Richardson, Vol i., page 170 et seq., published by Baillière; and before concluding, I would only add that it is quite possible for one coal to have a higher per centage of "heat-giving properties" than another having a lower per centage, and yet be said to evaporate less water than the lower one. The nature of the "heat-giving properties" must be considered; for one thing the combustion of a given weight of hydrogen has been found by experiments of a perfectly undoubted character, indeed, thoroughly established, to give an amount of heat as near as may be 4½ times as great as the same weight of carbon,* and, consequently, if the hydrogen, under certain circumstances, be greater in the coal of the lower per centage of "heat-giving properties" than in the coal with the higher per centage of "heat-giving properties," which it is in the coals referred to by Mr. Bethell, it might give it a comparatively greater power, which it really does, and which is what I have said in my report.

Trusting that I have shown that my experiments, and the conclusions deduced therefrom, contained in my report upon the fuel of the South Western Railway Company, are neither absurd, anomalous, nor can be challenged,

I remain, &c.,
DUGALD CAMPBELL,
Analytical Chemist to the Brompton Hospital, &c.
7, Quality-court, Chancery-lane, W.C.,
May 25th, 1859.

ORIGIN OF THE ELECTRIC TELEGRAPH.

Sir,—In his letter under this head, Mr. MacGregor expresses a hope that a description of a modern railway locomotive may perhaps be found in some ancient Sanscrit manuscript. Not being acquainted with that language I cannot assist him in the search, but if that gentleman will have the kindness to turn to the Eighteenth Book of Homer's Illiad, verse 373, he will find a very fair description of thirty golden locomotive tripods, moving upon wheels by means of an inward spirit, and the last line literally describes old Vulcan as just closing the last rivets.

Mr. MacGregor may also refer to the Second Book of Spenser's Faery Queen, where he will find a splendid description of two of our great modern discoveries.

In the Sixth Canto, the screw steamer, imaginatively brought to a very high perfection, and in the Forty-Sixth, an equally beautiful description of the electric light.

The suggestion of sympathetic dial-plates, or an electric telegraph, by the Abbé Barthelemy, may be found related in one of the papers of Addison's "Spectator."

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* The results of experiments by Dulong, Favre, and Silbermann, Grassi, Andrews.

These and many other instances go far to prove the great power of the human mind, that is to say, the power of preconceiving the possibility of accomplishing certain effects only to be discovered in after ages.

I am, &c.,
HENRY W. REVELEY.

Poole, May 21st, 1859.

Proceedings of Institutions.

Ashford.—South Eastern Railway Mechanics' Institution.—The report for the half-year ending March 31st shows that the number of members has risen from 114 to 138, being four more than at the corresponding season of last year. The library has been considerably improved by the addition of a new and commodious bookcase, and 26 volumes added to it during the half-year, 16 of which were presented by S. Smiles, Esq. The number of volumes now in the library is 882. The drawing and mathematical classes, authorised by the members at the last general meeting to be organised, have been more successful than usual, and it is the desire of some members to carry them on all the year. The council have sanctioned the formation of a chess club in connexion with the institution, and allowed it to use the council room for its meetings. The club, which now consists of 18 members, meets every Monday evening, and is remarkably well attended. The lectures have been particularly well attended by the members this season. The half-yearly accounts have been duly audited, and found in a satisfactory condition.

Yorkshire Union.—The following statement has been issued by this Union in reference to their Village Library:—The Itinerating Village Library, which comprises 45 sections, each containing 50 volumes, or a total of 2,250 volumes, was established with the view of encouraging a taste for reading among the inhabitants of small towns and villages, and of providing the means of disseminating useful information and entertainment of a moral character in places where no such means previously existed, and where a difficulty might be experienced in procuring wholesome literature except at a price beyond the means of the great majority of the population. It ought not to require any arguments to show the great advantages of reading, and the importance of promoting a more general resort to such an employment of leisure hours. It is at once the cheapest and most enduring recreation, available almost at all times and under all circumstances, storing the mind with fruitful and pleasant food for the thoughts, and supplying abundant means for real gratification. When once the capability of reading has been acquired, the man whose day has been spent in labour may recruit his exhausted energies by exercising his mental faculties, and at the same time improve his position by informing himself of the laws of nature, and of those principles which most nearly affect his general interests. It is not only a never-failing but an increasing source of the purest delight, opening the eyes as it were to new worlds, and making apparent mysteries subjects of familiar knowledge. The agriculturist, whether farmer or labourer, may learn the processes by which manures stimulate vegetation, the way in which tillage operates to fertilize the earth, the mode by which roots, leaves, and seeds are formed in the plants which he cultivates, and the surest method of promoting the result which he requires. The cottager may learn something in the production of fruit, flowers, and vegetables, and the country have new charms for all, because its beauties will become more intelligible. The manufacturer, whether employer or artisan, may learn the means by which his objects are accomplished, and achieve greater success by comprehending the causes of failure. As a writer in *Chambers' Miscellany* has well observed, "A man should not be satisfied with being merely skilled in his handicraft. He ought to make himself acquainted with the principles of the operations in which he is concerned. If, for instance, he be a dyer, he should not rest contented with knowing what ingredients will produce certain tints, but ascertain why such is the case. This will cause him to study practical chemistry; and in the course of his investigations he may perhaps make some discovery valuable to himself and the public. Independently, however, of any chance of making improvements in his profession, much good is gained by investigations into first principles." The Rev. H. Moseley, in his report on Education, says:—"The workman need not think, however humble be the craft he exercises, or common the form of matter on which he is called upon to labour, that the science is a thing of small account. Nothing is of small account which comes from the hand of the Almighty, or any truth which is a manifestation of the Divine mind. The man who has acquired the knowledge of a law of Nature, holds in his hand one link of a chain which leads up to God, whether it be developed from the rude fragment of a rock, or from a sunbeam—whether found in the organisation of an insect, or in the mechanism of the heavens. It is in the separation of labour from that science or knowledge which is proper to every form of it, that consists the degrading distinction of a class of the community (in the language of the manufacturing districts) as 'hands.' 'Hands!'—Men who take a part all their lives long in manufacturing processes, involving the practical application of great scientific truths, without ever comprehending them—men, who have before their eyes continually mechanical combinations, the contrivance of which they never take the pains to inquire into—men, in respect to whom the first step has never been made which all these things would have continued, the first impulse given which these would have carried on—men, who with subjects of thought all around them, and with everything to impel them to the exercise of it, never exercise thought; and so, the obvious means of their education being passed, they remain always 'hands.'" Beyond all this there is the gratification afforded by the perusal of works of Travel; the descriptions of foreign countries and people, with their manners and customs; the history of our own and other nations; the lives of great and good men which serve for example and encouragement; the models of language in the Essays and other productions of celebrated writers; and not the least important the cultivation of the imaginative faculties by the inimitable poetry of Shakspere, Milton, Pope, Cowper, and other English worthies. For the brief interval of leisure, there are numerous volumes of miscellaneous literature in which entertainment and information are happily blended, while the works of Sir Walter Scott and other writers of fiction may convey a moral lesson in the guise of an interesting tale. A much greater advantage would be gained and additional enjoyment experienced by adopting the practice of reading aloud. More is learned from the voice than by the eye, and though some would feel a little difficulty at first, perseverance would soon render it easy, and even preferable to the silent perusal of a book. It would moreover enable the whole of the domestic circle to share in the information or entertainment which the book may afford, prove an additional bond of family union, promote a desire for knowledge in children, and become a real attraction for home, the prospect of which would sweeten the toils of the day. The duties of reading might be shared by all who are capable of it, so that the "Evenings at home" might even to the poorest prove a never failing delight. The contents of the Yorkshire Union Village Library may be thus classified, and every section of fifty volumes contains a fair selection of each, with some little variety:—

Tales, Novels, and light literature	347 vols.
Historical works	313 do.
Biographical works	293 do.

Miscellaneous works	243	vols.
Travels, &c., in various parts of the World	226	do.
Scientific works	127	do.
Descriptive works	115	do.
Poetical works	114	do.
Agriculture, Gardening, and the Vegetable Kingdom	71	do.
The Animal Kingdom	71	do.
The Fine Arts	43	do.
Social and Domestic Economy	39	do.
Essays, &c.	29	do.
Educational works	28	do.
Philosophical works	28	do.
Manufactures and Commerce	19	do.
Lectures, Letters, &c.	16	do.
Classics	14	do.
Sundry works not otherwise classified	114	do.
Total	2,250	

The terms are 1s. per quarter for each member, to be paid in advance, but where a reading-room with periodicals is also provided, special terms may be made to suit the convenience of each locality. The carriage of the boxes each way is paid by the Yorkshire Union, and may be deducted from the total subscriptions. Communications may be addressed to the agent, Mr. Barnett Blake, Mechanics' Institute, Leeds.

MEETINGS FOR THE ENSUING WEEK.

MON. ......British Architects, 8.
TUES. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Civil Engineers, 8.
WED. ......Geological, 8. Mr. J. Lancaster, "On the Sinking for Coal at the Shireoaks Colliery." 2. Mr. A. Selwyn, "Notes of the Geology of Southern Australia." 3. Mr. James Lemont, "Notes on Spitzbergen."
THURS .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Antiquaries, 8.
Linnæan, 8. Mr. Bentham, "On *Homalium*." 2. Mr. Bentham, "Synopsis of *Dalbergieæ*."
Chemical, 8.
FRI. ......Archœological Inst., 4.
Royal Inst., 8½. Prof. Huxley, "On the Persistent Types of Animal Life."
SAT..........Actuaries, 3. Anniversary.
Royal Inst., 3. Mr. J. P. Lacaita, "On Modern Italian Literature."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered on 16th and 18th April, 1859.

27. Schools (Wilts)—Return.
183. Marine Engines—Copy of Report.
203. National Vaccine Board—Copy of Report.
214. Public Income and Expenditure (Year ended 31st March, 1859)—Account.
219. Foreign Shipping—Account.
111. Bills—Offences against the Person.
112. " Forgery.
113. " Malicious Injuries.
114. " Coinage Offences.
115. " Personation.
116. " Criminal Writings.
117. " Larceny.

Delivered on 19th April, 1859.

200. East India (Principality of Dhar)—Return.
215. Common Lodging Houses—Return.
Guano—Correspondence with the Agents of the Peruvian Government.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 20th*, 1859.]

Dated 1st April, 1859.

818. W. E. Newton, 66, Chancery-lane—Imp. in cricket bats. (A com.)

Dated 8th April, 1859.

884. W. E. Newton, 66, Chancery-lane—Imp. in telegraphing and in telegraphic apparatus. (A com.)

Dated 11th April, 1859.

902. W. Boaler, Manchester—Certain imp. in the manufacture of soap. (Partly a com.)

Dated 18th April, 1859.

976. W. E. Gedge, 4, Wellington-street South, Strand—An improved safety apparatus for clearing off condensed steam from steam engines. (A com.)

Dated 19th April, 1859.

984. W. Gosling, 82, Wellington-street, Woolwich, Kent—Improving rifle cannon and projectiles.

Dated 20th April, 1859.

998. J. Apperly and W. Clissold, Dudbridge, Gloucestershire—Improved apparatus for oiling wool.

Dated 26th April, 1859.

1044. W. Mackenzie, Glasgow—An improved method of printing impressions upon an enlarged or reduced scale, either from engraved plates, electrotypes, blocks, drawings, or other surfaces.

Dated 27th April, 1859.

1056. J. Stuart, Musselburgh, Mid-Lothian, and W. Stuart—Imps. in machinery or apparatus for manufacturing nets for fishing, and for other purposes.

Dated 28th April, 1859.

1065. C. Randolph and J. Elder, Glasgow—Imp. in steam engines and boilers.
1067. R. Harrington, 3, Colonnade, Albany-road, Camberwell—Imp. in umbrellas and parasols.
1069. N. J. Holmes, Glasgow—Imp. in electric telegraphs and apparatus connected therewith.
1070. E. Lardenois, Brussels—Imp. in the manufacture of pulp for paper, pasteboard, and other like articles.
1071. T. Clarke, Hackney—Imp. in sheaves or pulleys for paying out and hauling in ropes, chains, and cables, for communicating motion to machinery, and for other useful purposes.
1073. W. A. Tompson, 18, Cecil-street, Strand, and W. Green, Thames Ditton, Surrey—Imp. in apparatus for applying liquids to the throat and air passages for medical purposes.

Dated 29th April, 1859.

1076. W. Corbett, Clayton, near Manchester, and W. Carmont—Certain imp. in the construction and arrangement of furnaces employed in the manufacture of iron and steel, and for other similar purposes.
1077. J. W. Welch, Manchester—Imp. in sizing or dressing yarns or threads for weaving.
1079. E. A. Porteus, 18, Warwick-square, Paternoster-row, and W. H. Burke, 79, Cannon-street, West—Imp. in printing and other presses.
1081. T. Smith, Bredfield, Suffolk—Imp. in cultivating implements.

Dated 30th April, 1859.

1083. J. Toussaint, 1B, Welbeck-street, Cavendish-square—A new process of modelling and moulding for galvano-plastic.
1084. J. Darlington, 36, Cannon-street—Imp. in zinc retort furnaces.
1085. E. Francis, Wrexham, Denbigh—Improved apparatus applicable to the treatment of tea and other useful purposes.
1086. J. Morison, sen., and J. Morison, jun., Paisley—Imp. in looms and in apparatus connected therewith.
1087. W. Clark, 53, Chancery-lane—Imp. in ventilating or supplying air to diving bells and divers, and in holding communicating therewith from above. (A com.)
1089. J. Bull, Port-street, Manchester—Imp. in apparatus used for securing bales of cotton and other substances.
1090. C. H. G. Williams, 39, Regent-square, Gray's-inn-road—Imp. in the manufacture of colouring matters, and in applying the same for dying and printing fabrics and materials.
1091. J. Souquière (called Emile), 29, Boulevart St. Martin, Paris—A new or improved process for distilling coal.

Dated 2nd May, 1859.

1092. T. H. Arrowsmith, Bolton—Imp. in carding engines.
1093. A. Jumelais, Paris—An apparatus yielding illimited power, "so-called French movement."
1094. J. Ferguson, Kilmarnock, Ayr, N. B., and J. Mc Gaveny, Glasgow—Imp. in fasteners for shutters and for similar uses.
1095. W. Bayliss, Wolverhampton—Imp. in the manufacture of iron hurdles and fencing.
1096. R. A. Brooman, 166, Fleet-street—Imp. in, and in connection with, electro-magnetic engines. (A com.)
1097. J. Basford, Brick-yard, Oundle, Northampton—An imp. in the apparatus used when expressing clay or brick earth through dies.
1098. J. Childs, Windsor House, Putney, Surrey—Imp. in the manufacture and useful application of certain alkaline silicates, and in the production of liquor silicis, or liquid flint.
1100. D. Moore, Brooklyn, New York—Imp. in machinery for rubbing or dressing types.
1101. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of caustic soda and carbonate of soda, from certain alkaline liquors and salts.
1102. C. Nuttall, Rochdale—Imp. in machinery or apparatus for grinding wire cards.
1103. F. W. Emerson, 110, Fenchurch-street—Imp. in treating ores to obtain a new metallic substance and its salts, and in the application of such matters, and also certain products of tungsten in dyeing, printing, and painting.

Dated May 3rd, 1859.

1104. A. G. Franklin, 14, South street, Finsbury—Imp. in the manufacture of crayons. (A com.)
1105. W. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture or production of mineral oil and grease. (A com.)
1107. W. Clark, 53, Chancery-lane—Imp. in obtaining or extracting quinine and the principal organic alkalies. (A com.)
1109. W. Sellers, Philadelphia, U.S.—Improved machinery for making screw bolts and nuts.

1112. H. Chapman, Battlebarrow, Appleby, Westmoreland—An improved military camp cooking apparatus.

1113. H. Chapman, Battlebarrow, Appleby, Westmoreland—Imp. in the construction of kettles.

1114. E. W. Scale, Merthyr Tydvil, Glamorganshire—Imp. in railway signals.

1115. R. Mushet, Coleford, Gloucestershire—An imp. in the manufacture of cast steel.

Dated 4th May, 1859.

1116. W. H. Kingston, A.B., Trinity College, Dublin—Improved means of communication between the passengers and guards, and guards and engine drivers of railway trains.

1117. C. F. Vasserot, 45, Essex-street, Strand—An improved form of tuyere for blast furnaces. (A com.)

1118. J. Adolphus, 1, Serle-street, London—An imp. in locks, bolts, and latches.

1119. W. E. Newton, 66, Chancery-lane—Imp. in steam boilers. (A com.)

1120. J. G. Willans, 2, Clarence-place, Belfast—Imp. in utilizing bog stuff or peat, when applied for treating metals and certain mineral and alkaline substances.

1121. J. G. Wilson, 1, Langley-place, Victoria-park, Manchester—Imp. in machinery for cleaning cotton.

Dated 5th May, 1859.

1122. H. Turner, Park-street, Mile-end—Imp. in steam engines and apparatus connected therewith.

1123. J. F. Allender and D. Rowley, Brierley-hill, Staffordshire—Imp. in shears for cutting boiler plates and sheets, and for other like purposes.

1124. J. Scholfield and W. Cudworth, Milnrow, near Rochdale—Certain imp. in machinery or apparatus for spinning cotton and other fibrous materials.

1125. H. Chapman, Battlebarrow, Appleby, Westmoreland—Improved means or appliances for protecting ships against injury from shots, shells, or other warlike projectiles.

1126. H. Chapman, Battlebarrow, Appleby, Westmoreland—Imp. in the construction of fortifications.

1127. W. F. Batho and E. M. Bauer, Salford, near Manchester—Imp. in drills for recessing, cutting slots, keyways, and cotter holes.

1129. W. Clark, 53, Chancery-lane—Imp. in seed depositors or drills. (A com.)

1130. A. Knox, 2, Victoria-cottages, Hertford-road, Kingsland—Imp. in gas regulators.

1131. H. Reynolds, Denmark-hill, Surrey—Imp. in refining sugar and other saccharine substances.

1132. R. A. Brooman, 166, Fleet-street—Imp. in cannon and other fire-arms, and in projectiles, wads, and cartridges to be used therewith. (A com.)

1133. H. Fletcher, 42, Southampton-buildings, Chancery-lane—A machine for scutching and carding tow, oakum, or waste cordage. (A com.)

1134. W. E. Newton, 66, Chancery-lane—An improved steam gauge. (A com.)

1135. W. E. Newton, 66, Chancery-lane—Certain imp. in fish-hooks. (A com.)

1136. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in pianofortes. (A com.)

Dated 6th May, 1859.

1137. W. Kellingley, 13, Mason-street, New Cross, Surrey—Imp. in the mode of lubricating the journals of the axles of locomotive engines of carriages and machinery.

1138. F. Angerstein, Kennington, R. Clegg, Islington, and G. Thorrington, Egham, Surrey—Imp. in apparatus for obtaining motive-power.

1139. F. W. Hart, Horncastle, Lincolnshire—Imp. in photographic apparatus.

1140. S. Wright, Sudbury—An improved gas governor or regulator.

1141. J. Dixon, Blackburn—Imp. in machinery or apparatus for staining paper.

1143. W. S. Booth, Birmingham—A new or improved washing machine.

1144. J. Frearson, Birmingham—New or improved fastenings for wearing apparel, and for such other purposes as the same are or may be applicable to.

1145. G. T. Bousfield, Loughborough-park, Brixton—Imp. in apparatus for grinding grain and other substances. (A com.)

Dated 7th May, 1859.

1146. J. Combe, 23, Rue du Champ de Mars—An improved plantoforme or apparatus for measuring the hoofs of horses for the purpose of forming their shoes.

1147. J. Bray, Staley Bridge, Chester, and J. W. Harrison, Staley Bridge, Lancaster—Imp. in machinery or apparatus for spinning fibrous materials.

1148. A. C. Bamlett, Middleton Tyas, Yorkshire—Imp. in reaping machines, part of which improvements is applicable to other agricultural implements.

1149. M. Henry, 84, Fleet-street—Imp. in the manufacture and construction of locks and fastenings. (A com.)

150. R. Mushet, Coleford, Gloucestershire—Imp. in puddling iron and steel.

1151. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of iron.

1152. C. Frost, Sun Tavern Fields, St. George's-in-the-East—Imp. in the construction of electric telegraph cables.

1153. R. Pearsall, Smethwick, Staffordshire—Imp. in the manufacture of glass shades.

1154. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in the manufacture of steel. (A com.)

1155. R. D. Kay, Accrington, Lancashire—Imp. in the preparation of certain colouring matters. (A com.)

1156. W. Jeffery, Eastgate-street, Gloucestershire—Rendering more convenient out-door manipulations in photography by means of an improved portable photographic tent and tent camera.

Dated 9th May, 1859.

1157. J. Ramsbottom, Crawshaw Booth, near Rawtenstall, Lancashire—Certain imp. in machinery for printing fabrics.

1159. C. A. H. Marcoux, 71, Rue de Ruisseau, Montmarte, near Paris—A new impelling mover by the pressure of water.

1163. A. Morton, Morton-place, Kilmarnock, Ayr—Imp. in means or apparatus employed in the weaving of figured fabrics.

1165. T. Green, jun., Old Broad-street—Imp. in apparatus applicable to steam boilers, to obtain greater security against explosion.

Dated 10th May, 1859.

1167. Major W. F. Nuthall, North-lodge, Kilburn—Imp. in ordnance and fire-arms, and in projectiles to be used therewith.

1169. W. Wilkinson and C. Whitley, Manchester—Imp. in buttons and fastenings for garments, harness, and other similar purposes, and in the method of securing the same.

1171. J. Norman, Glasgow—Imp. in furnaces.

1173. G. Bell, Wandsworth, Surrey—Imp. in matches or fusees.

1175. W. Keiller, Perth—Imp. in cartridges for guns or small fire-arms.

1177. J. Absterdam, New York, U.S.—Imp. in impregnating illuminating gas with hydro-carbon vapour.

Dated May 11th, 1859.

1179. A. Manbré, 10, Rathbone-place, Oxford-street—The manufacture of a colouring matter for colouring spirits, beers, vinegar, and other liquids, from sugar produced from rice, maize, carrots, maple, ananas, pompions, chesnuts, mangel-wurtzell, sorgho, turnips, and Jerusalem artichokes.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, May 20th*, 1859.]

May 21st.

2632. J. Wadsworth.
2635. H. Ellis.
2636. C. Tomlinson.
2637. C. Cuit.
2638. W. Lea.
2640. H. Jordan.
2646. H. Gardiner.
2648. R. Nelson.
2650. S. W. Johnson & J. Varley.
2656. W. Gorman.
2662. R. H. Hughes.
2759. J. Baillie.
2761. M. Henry.
2771. J. Cameron.
2783. M. Henry.
2787. J. Jobson.
2813. M. Henry.
2872. A. V. Newton.
2972. W. Haworth & W. Barker.
2977. T. Pickford.
526. J. Howden.
716. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.

Dated 24th May, 1859.

May 24th.

2663. R. A. Brooman.
2668. C. Peterson.
2671. C. E. Amos.
2678. F. H. Maberly.
2680. F. Loos.
2691. J. B. Booth.
2693. P. Griffiths and J. Brennand.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, May 20th*, 1859.]

May 16th.

1239. T. Herbert & E. Whitaker.
1291. R. Jobson.

May 17th.

1178. G. Carter.
1194. A. V. Newton.
1297. H. Cartwright.

May 18th.

1180. J. Brown.
1187. W. Maugham.

Dated 24th May, 1859.

May 20th.

1219. J. C. Pearce.
1226. R. Bell.
1315. E. Heywood and T. O. Dixon.

May 21st.

1250. B. Nadault de Buffon.
1267. W. E. Newton.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4172	May 13.	Improved Levelling Staff	Elliott. Brothers	30, Strand, London, W.C.
4173	,, 13.	Improved Attachment for Box Fastener	Charles Lambert and Son	Fillwood Works, near Bristol.
4174	,, 14.	The Etna Kettle	Edgar Parks	140, Fleet-street, E.C.
4175	,, 17.	An Adjustable Vice	John Walters and Co.	Globe Works, Sheffield.
4176	,, 21.	The Universal Post Advertiser	The Permanent Advertising and General Agency Co., Limited	78, Gracechurch-street, London, E.C.

Journal of the Society of Arts.

FRIDAY, JUNE 3, 1859.

EXHIBITION OF 1861.

The following Resolutions have been passed by the Council of the Society of Arts :—

Resolved,—That with reference to the present and prospective condition of the Continent, the Council is of opinion that the International Exhibition proposed to be held in 1861 should be postponed to a more favourable opportunity.

That this resolution be communicated to His Royal Highness the President of the Society, and to Her Majesty's Commissioners for the Great Exhibition of 1851.

That the Chairman be requested to prepare a report of the proceedings which have been taken by the Council to ensure the success of the intended International Exhibition of 1861, together with an explanation of the grounds on which the Council has come to the conclusion that the Exhibition should be postponed to a more favourable opportunity.

That the Chairman's statement form part of the Annual Report to be laid before the Annual General Meeting on the 29th June next.

That the foregoing Resolutions be communicated to the Guarantors.

The following letter has been addressed to the Guarantors :—

Society of Arts, Manufactures, and Commerce, Adelphi,
London, W.C., 31st May, 1859.

Sir,—I am directed to forward to you, as one of the Guarantors, a copy of the resolutions (see above) which have been passed by the Council in reference to the proposed Exhibition of 1861, and to inform you that the sums already given in to the Council, as intended to be guaranteed, have been such as to leave no doubt of the list being fully completed to the amount required. The Council, however, looking at the state of Italy and the threatening condition of other countries, have determined to postpone action for the present in reference to an International Exhibition. The Council, considering the large amount of support which they have received from intending Exhibitors and others, will again take measures for holding the Exhibition as soon as the state of foreign countries will admit of its being international, and they hope you will allow your name to be retained in the list of those who are willing to give the guarantee when the more favourable opportunity alluded to in the first resolution may have arrived.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

EIGHTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Eighth Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on Monday, the 27th instant, at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference.

ANNUAL DINNER.

The One hundred and fifth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on Monday the 27th instant, at half-past five for six o'clock punctually. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Monday, the 13th instant.

EXHIBITION OF INVENTIONS.

The Exhibition will remain open every day until Thursday, the 30th inst., and is free to members and their friends. Members by ticket, or by written order bearing their signature, may admit any number of persons. Members of Institutions in Union with the Society are admitted on showing their cards of membership.

EXAMINATION PRIZE FUND, 1859.

The following are the Donations up to the present date :—

	£	s.
John Ball, Examiner in Book-keeping (2nd donation)	5	5
Harry Chester, Vice-Pres. (2nd donation)	5	0
C. Wentworth Dilke, Vice-Pres., Chairman of Council (4th donation)	10	10
T. Dixon	1	1
Frederick Edwards (annual)	1	1
J. G. Frith, Mem. of Council (2nd donation)	5	5
George Goff	5	0
F. Seymour Haden (annual)	2	2
W. Haldimand	10	10
Edward Highton (annual)	2	2
James Holmes (annual)	1	1
Henry Johnson (2nd donation)	25	0
London Committee of the Oxford Middle Class Examinations	5	5
Charles Ratcliff (annual)	10	10
Dr. Skey	1	1
Rev. Dr. Temple	6	6
A Teacher	5	0
Matthew Uzielli	50	0
Rev. A. Wilson	2	2

EXAMINATIONS, 1859.

The number of papers worked in each subject this year is as follows :—

Arithmetic, 232.
Bookkeeping, by Double Entry, 84.
Algebra, 82.
Geometry and Mensuration, 45.
Trigonometry, 17.
Conic Sections, 4.
Statics, Dynamics, and Hydrostatics, Hydraulics, and Pneumatics, 17.

Practical Mechanics, 7.
Magnetism, Electricity, and Heat, 5.
Chemistry, 28.
Animal Physiology, 2.
Botany, 2.
Political and Social Economy, 14.
Geography, 28.
English History, 38.
English Literature, 30.
Latin and Roman History, 18.
French, 87.
German, 14.
Theory of Music, 12.

The papers are now in the hands of the Examiners, and it is expected that the results of the Examinations will be published in next week's *Journal.*

CONVERSAZIONE.

The second Conversazione of the present session took place on Saturday evening, the 28th of May, at the South Kensington Museum. The entire range of buildings was thrown open, including the Sheepshanks Gallery of Pictures, the Sculpture Gallery, the Architectural Museum, the Animal Produce Collections, the Ornamental Art Collections, the Structure and Building Materials Collections, the Educational Collections, and the Art Training Schools, as well as the new rooms recently constructed for the reception of the Vernon and Turner Collections. The Museum of Patented Inventions was also open to visitors, by permission of the Commissioners of Patents. The programme distributed to the visitors included a ground plan of the building, and also a plan of the estate purchased with the surplus funds of the Great Exhibition of 1851, showing the proposed site for that of 1861. The band of the Coldstream Guards was in attendance, and performed the following selection:—

Overture "Le Cheval de Bronze"...	Auber.
Valse, "Queen of the Harvest" ...	C. Coote, jun.
Glee, "The Winds whistle cold"...	Sir H. R. Bishop.
Selection, "Satanella"	Balfe.
Quadrille from Flotow's Opera, "Martha."	
Quadrille, "Reminiscences of Auber."	
Polka, "The Coldstream Guards" (Cornet Solo, Mr. Buchanan)......	A. F. Godfrey.
Glee, "The Red Cross Knight" (Euphonium Solo, Mr. Phasey ...	Dr. Callcott.
Selection, "Il Trovatore," introducing the celebrated Miserere ...	Verdi.
Valse, "Immortellen"	Gung'l.
Morceau Militaire, "The Retreat"	Gaston de Lille.

"God save the Queen" was played shortly after eleven o'clock.

The company was received on entering by Mr. C. Wentworth Dilke, Chairman, and the members of Council.

Refreshments were served in one of the new rooms prepared for the Turner and Vernon collections of pictures.

The number of members and their friends present amounted to nearly 3,000.

The following letter has been addressed to the Lord President of the Privy Council:—

Society of Arts, Manufactures, and Commerce,
Adelphi, London, W.C., June 2nd, 1859.

My Lord,—The Council of the Society of Arts desire to thank your lordship for the use of the South Kensington Museum, which their members and friends enjoyed, by your kind permission, on Saturday evening last, at the Society's annual reception.

The Society of Arts, as your lordship is aware, from the large range of objects which it embraces, includes members in every class of society, and, on the invitation of the Council, a very large number availed themselves of the privilege conceded by your lordship, and with intelligent interest thronged every part of the extensive Museum, particularly the Art Galleries, which, to their own great intrinsic merits, add the novel attraction of a collection of pictures most successfully lighted for evening exhibition.

The Council are sure that your lordship will share the satisfaction they feel in the warm appreciation expressed for these popular collections of art and science, and the conviction impressed on the minds of all of the great advantages which must result from the freedom of access that, under your lordship's direction, has made them so convenient for all classes.

The Council request me to express their best acknowledgments for the valuable assistance of the officers of the Museum, by whose arrangements the comfort of their visitors was so well considered.

I have the honour to be, my Lord,
Your Lordship's most obedient servant,
P. LE NEVE FOSTER, Secretary.

The most Noble the Marquis of Salisbury, K.G.,
Lord President of the Privy Council, Downing-street, S.W.

THE NORMAL DIAPASON.

The *Moniteur* of the 25th February contained the Report presented to his Excellency, the Minister of State, by the Commission charged with the task of establishing in France a uniform musical diapason.* Decree of the 17th July, 1858.

The following translation is taken from the *Musical World*:—

Paris, the 1st February, 1859.

Monsieur le Ministre,—You charged a Commission to "Investigate the means of establishing in France a uniform musical diapason, to fix on a standard of sonority which might serve as an invariable type, and to point out the measures to be passed in order to secure its adoption and preservation."

Your order was founded on the following considerations:—"The constantly increasing elevation of the diapason is attended with drawbacks, from which musical art, musical composers, artists, and musical instrument makers are all sufferers; and the difference existing between the diapasons of various countries, various musical establishments, and various manufactories, is a constant source of embarrassment for concerted music, and of difficulties in commercial transactions."

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* The Commission consisted of—MM. J. Pelletier, Councillor of State, Secretary General in the Ministry of State, President; F. Halévy, Member of the Institute, Perpetual Secretary of the Academy of Fine Arts, Reporter; Auber, Member of the Institute, and Director of the Imperial Conservatory of Music and Elocution; Berlioz, Member of the Institute; Despretz, Member of the Institute, and Professor of Physics at the Faculty of Science; Camille Doucet, head of the theatrical department in the offices of the Minister of State; Lissajous, Professor of Physics at the Lycée Saint-Louis, and Member of the Council of the Society for the Encouragement of National Industry; General Mellinet, charged with the organisation of the bands of the army; Meyerbeer, Member of the Institute; Ed. Monnais, Imperial Commissary at the lyrical theatres and the Conservatory; Rossini, Member of the Institute; Ambroise Thomas, Member of the Institute.

The Commission has terminated its task. It owes you an account of its operations and of the course it has pursued, and it submits to the approbation of your Excellency the result to which it has come.

I.

It is certain that, in the course of a century, the diapason has been progressively and constantly rising. If the study of Gluck's scores were not sufficient to prove, by the manner in which the vocal parts are arranged, that these master-pieces were written with reference to a diapason much less high than ours,* the testimony of contemporary organs would furnish us with irrefutable proof. The Commission desired, in the first place, to account for this singular fact, and, just as a prudent doctor endeavours to go back to the first sources of a malady before attempting to cure it, resolved to discover, or, at least, examine, the causes which had been able to effect the elevation of the diapason.

We possess the elements necessary for estimating this elevation. The organs, of which we have spoken, mark (*accusent*) the difference of a tone below the existing diapason. But even this moderate diapason was not sufficient for the prudence of the opera at that period. Rousseau, in his Dictionary of Music (under the article *Tone*), says that the *tone* of the Opera at Paris was *lower than the tone of the chapel.* Consequently, the diapason, or, rather, the *tone*† of the Opera was, in Rousseau's time, more than a tone lower than the diapason of the present day.

The singers of the period, however, according to a great many writers, forced their voices. Either from want of study, want of taste, or a desire to please the public, they screeched (*criaient*). Such singers, who could manage to screech so loudly with so low a diapason, had no interest in asking for a higher *tone*, which would have required greater exertions; and generally at no time, in no country, neither to-day nor formerly—in a word, never is it the interest of the singer, let him sing well or ill, to meet with a high diapason, which deteriorates his voice, augments his fatigue, and shortens his theatrical career. Singers, therefore, are out of court, and we cannot attribute the elevation of the diapason to them.

The interest of composers—despite whatever may have been said or thought by persons not possessing a very precise notion of musical matters—is directly contrary to the elevation of the diapason. When it is too high, it embarrasses them. The higher the diapason, the sooner does the singer reach the limits of his voice on the sharp chords; the development of the melodic phrase is, therefore, trammelled rather than seconded. The composer has in his head, his imagination, and, we may say, in his heart, the natural type of the human voice (*des voix*). The phrase he writes is suggested to him by a singer whom he alone hears, and who always sings well. This singer's voice, supple, pure, intelligent, and correct, is fixed in conformity with a moderate and true diapason which dwells within the ear of the composer. The composer has, therefore, every advantage to gain by moving in a gamut well suited to the voice, and which, leaving him freer, and more master of the effects he desires to produce, assists his inspiration. Besides, what means does he possess of raising the diapason? Is it he who himself makes, or causes to be manufactured, the perfidious little instruments, the compasses which mislead the mariner? Is it he who comes and gives the A to orchestras? We have never seen or heard that any *maestro*, discontented with the too great reserve of a diapason, had one made to suit his convenience—a personal diapason, in order to raise the *tone* of an entire orchestra. He would meet with a thousand cases of resistance, and a thousand impossibilities. No; the composer does not create the diapason; he submits to it. He cannot, therefore, be accused of having excited the ascensional course of tonality.

We must remark that this ascensional course has been general as well as constant; that it has not been limited to France; and that the Alps, the Pyrenees, and the ocean have not proved obstacles to it. People must not, therefore, as we have heard them do, accuse especially France, whom they are very apt to charge with the misdeeds committed from time to time in the world of music. Our country has merely had a share in the grand invasion of the rising diapason, and, if it was an accomplice in the crime, it was also the victim of it. The causes of this invasion, which have acted everywhere with consistency, *ensemble*, perseverance, and, we might say, premeditation, could not be either accidental or peculiar to one country. They must necessarily have been dependent upon a determining principle, and an interested motive. In virtue of a well-known axiom, we must, therefore, seek out those evidently interested in unduly raising the A which our ancestors hoped to bequeath us.

It is those who manufacture tuning-forks, or have them manufactured, who are the authors of the evil and masters of the situation. It is the musical-instrument makers, and we can understand that they have a legitimate and honourable interest in elevating the diapason. The more elevated the *tone*, the more brilliant will be the sound. The maker will not, therefore, always manufacture his instruments in conformity with the diapason; he will sometimes manufacture his diapason in conformity with an instrument he may consider sonorous and striking. The truth is, that he is a passionate admirer of sonority, which is the object of his work, and is incessantly endeavouring to increase the force, purity, and transparency of the voices which he knows how to create. The wood he fashions and the metal he forges, obeying the laws of resonance, will assume intelligent sounds, which a skilful, or, sometimes, an inspired artist, will soon animate with his bow, his breath, and his light, supple, or powerful fingers. The instrumentalist and the maker are, therefore, two allies; their interests are combined and mutually supporting. Once introduced into the orchestra, they sway and rule it, easily dragging it to the heights in which they delight. In fact, the orchestra belongs to them, or, rather, they are the orchestra, and it is the instrumentalist who, by giving the *tone*, regulates, without desiring to do so, the studies, the efforts, and the destiny of the singer.

The great sonority acquired by wind-instruments speedily found its direct application, and received from it a still greater impulse. Music, which adapts itself to everything, and everywhere takes its place, marches at the head of regiments; it sings to the troops the airs which animate them, and remind them of their native land. Under these circumstances, it must sound loud and firm, and its voice must extend a long distance. Military bands, seizing on the diapason and raising it still higher than it was before, propagated throughout

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* The scores of Monsigny and Grétry suggest the same remark.

† The word *diapason* had not then received the signification we lend it now-a-days, and the little instrument employed to give the *tone* did not exist. "The instrument which serves to give the *tone* (*ton de l'accord*) to a whole orchestra, and which some persons call a *choriste*, is a whistle, which, by means of a kind of graduated piston, by which the pipe is lengthened or shortened at pleasure, always emits pretty nearly the same sound under the same division, &c." (Rousseau, *Dictionnaire de Musique*, under the head *Tone.*) In Italy, at the present day, the name of *corista* is still given to the tuning-fork. One of the *choristes* mentioned by Rousseau is preserved in the "Cabinet de Physique" at the Sorbonne.

Europe the movement which incessantly hurried it forward.[*]

At the present day, however, military music might, without fear, descend somewhat from the diapason it has unduly raised. Its pride would not suffer, nor would its flourishes be less martial or less striking. The great number of brass instruments it now possesses have given it more body, and more firmness, as well as an amount of relief, both solid and brilliant, formerly wanting to it. Let us hope, moreover, that further progress on the part of the various makers speedily freeing certain instruments from drawbacks which are to be regretted, will open to them an access of rich tonality at present denied them. The honourable general who represents in the Commission the organisation of the military bands, would exert himself to the utmost to second this desirable amelioration—this real advance—which would endow military bands with fresh resources, and vary the brilliancy of their sonority.

We think, Monsieur le Ministre, we have proved that the elevation of the diapason is due to the efforts of instrument-makers and instrumental performers, and that neither composers nor singers have had any participation in it. Religious music and dramatic music have submitted to the movement, without being able to avoid it, or without endeavouring to escape doing so. The diapason might, therefore, be lowered to a certain extent, with the certainty of serving the true and greatest interests of art.

II.

We felt assured that the fact "of the constantly increasing elevation of the diapason" had not taken place in France alone, but that the whole world of music had been similarly hurried along; it was necessary, however, to obtain authentic proofs of this; is was necessary, also, to know to what extent, and in what different degrees, this influence had been felt in various countries, and in the principal centres of human activity.

We thought, therefore, M. le Ministre, that, in order to bring to a successful issue the researches with which your Excellency had charged us, it was requisite for us to begin by obtaining information abroad and at home, by questioning the heads of important establishments in France and foreign countries, by finding what was the general state of the diapason, and, in a word, by holding a sort of judicial inquiry (*enquête*). This course was, moreover, marked out by the very decree constituting us a Commission, and in which, with great justice, you mention "the difference existing between the diapasons of various countries, as a constant source of embarrassment."

Under your auspices, and through the medium of our president, we applied, therefore, to every place where there is an opera, or a grand musical establishment; to those towns where art is cultivated with love and success, and carried out with *éclat*, and which may be termed the capitals of music; we asked for information concerning the course followed by *tone*, and begged that the tuning forks in use at the present day might be sent us, as well as the old ones, if possible, so that we might measure exactly the discrepancy. At the same time, we requested those enlightened men to whom we applied, to acquaint us with their opinion of the actual state of the diapason, and their feelings, whether favourable or opposed, with regard to a lowering, or moderating of the *tone*. Music is a collective art; a sort of universal language. Every nationality disappears before musical writing, since a single system of notation is sufficient for all nations; since signs everywhere the same represent the sounds which form melody, or are grouped in chords; the rhythms which measure the time, and the various shades which colour the thought; even silence is written by this provident alphabet. Is it not desirable that a uniform diapason, henceforth invariable, should add a final link to this community of intelligence, and that an A always the same, counting all over the globe the same vibrations, should facilitate musical relations, and render them still more harmonious than at present?

It was with this view of the subject that we wrote to Germany, England, Belgium, Holland, Italy, and even America, and our correspondents have forwarded us conscientious answers, useful information, and interesting reminiscences. Some sent us old tuning-forks, half a century old, and now out of date; and others, contemporary ones, of various intonations. All of them, acknowledging and censuring the actual exaggeration, assured us of their cordial adhesion. Three of them, compatriots of ours,[*] while participating in the general opinion, ask, it is true, that the diapason shall be fixed by the actual state of the diapason of Paris; they do so, however, in order to stop it in its progressive ascent, and oppose an obstacle to future encroachments; but this, in our opinion, is an impotent obstacle, which protects the evil, and opposes it to itself, consecrating instead of destroying it. The rest are unanimous in desiring a less elevated diapason, uniform, and unalterable, a really international diapason, round which would rally, with unvarying agreement, the singers, instrumentalists, and instrument makers of all countries. Most of our foreign correspondents, besides expressing their approbation, praise us for having taken the initiative: "I am bound to thank you," writes one gentleman,[†] "for the important cause you have undertaken to plead; it is high time to stop the irregularities by which we have allowed ourselves to be carried away." "I adopt the sum total of your wise reflections," says another most distinguished conductor,[‡] "and hope all Europe will warmly applaud the nomination, by his Excellency the Minister of State, of a commission to establish a uniform diapason. The great elevation of the diapason destroys and effaces the effect and character of ancient music—of the masterpieces of Mozart, Gluck, and Beethoven."—"I make no doubt," writes another gentleman,[‖] "that the commission will succeed in this important question. This will be another act of service rendered by your nation to art and commerce."—"The progressive elevation of the diapason," writes another of our honourable correspondents,[§] "is not prejudicial to the human voice only, but likewise to all instruments. Stringed instruments especially have lost a great deal, as far as sound is concerned, since it has been indispensable, on account of this elevation, to employ very thin strings, strong ones not being able to stand the exaggerated tension; hence arises that sound which, instead of coming nearer and nearer, becomes more and more dissimilar to the human voice."—"To fix the diapason once for all," says a fifth,[¶] "would be to put an end to a great many doubts, as well as a multitude of annoyances, and even caprices. I assure you we take a lively interest throughout musical Germany in the execution of your project."—"You have said truly," writes another,[*] "that all Europe is interested in the researches undertaken for the purpose of establishing a uniform diapason. The musical world has long felt the urgent necessity of a reform, and thanks France for having taken the initiative."—M. Drouett, Capellmeister of the Grand Duke of Saxe-Cobourg-Gotha, has forwarded us three tuning-forks, of different periods and elevations, together with an interesting note. Lastly, we have received from two highly competent gentlemen, Herr Wieprecht, director of the military music of Prussia, in Berlin, and Dr. Furké, papers treating the subject in a most masterly manner. The authors entirely coincide with the idea which led to the appointment of the Commission.

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[*] We read in a letter addressed to us by M. Kittl, director of the Conservatory at Prague: "It is greatly to be desired that some conclusion should be arrived at in this matter, for there are continual complaints about the progressive elevation of the diapason, and all Europe will feel grateful that France has resolved to bestir herself, for she will not fail of success. In Austria, the military bands are the cause of this elevation, their diapason varying a semitone from that of other musical bodies. This difference dates from the time of the Emperor Alexander I. On becoming the proprietor of an Austrian regiment, he ordered new instruments to be made for the band. The maker, in order to bring out the latter with greater prominence, raised the diapason of the instruments, which, of course, imparted more freshness and brilliancy to the sound. The innovation excited the envy of the other military bands, who all raised their diapason."

[*] MM. Daussoigne-Méhul, Georges Hainl, and Auguste Morel.

[†] Herr Franz Erkel, Capellmeister at the National Theatre, Pesth.

[‡] Herr Reissiger, first Hof-Capellmeister at Dresden.

[‖] Herr Joseph Abenheim, director of the chapel of his Majesty the King of Wirtemberg.

[§] M. de Lwoff, Master of the Court, and Director of the Imperial Chapel at St. Petersburgh.

[¶] Herr Ferdinand David, Director of the Leipsic Conservatory.

These numerous instances of adhesion, emanating from such high authorities, make us feel certain that a proposition for lowering the diapason will be well received throughout Germany. We must, also, here mention that, as far back as 1834, a number of German musicians assembled at Stuttgart, and expressed a wish that the diapason should be lowered, recommending the adoption of an A considerably below our A at present in use.[†] There will certainly be, at first, some difficulties, arising more especially from the division of Germany into so large a number of different states. This is an opinion which one gentleman has expressed to us,[‡] but there is reason to believe that, after a few oscillations, an invariable and common type will be established in the above country, which is of great weight in the destinies of musical art.

From Italy we have as yet received only one letter. It is from M. Coccia, director of the Philharmonic Society at Turin, and *maestro di capella* of the Cathedral of Novara. M. Coccia has been kind enough to forward us the tuning-fork used at Turin;[‖] it is a little lower than that of Paris, and the mildest (*il più mite*), says M. Coccia, with which he has hitherto met. He recommends its adoption. Thus M. Coccia, also, is in favour of a *softening* of the tone, and this augurs well for the opinion of Italy, on which great stress should be laid.

From London, we have received a communication from Messrs. Broadwood, the celebrated pianoforte makers. They have been kind enough to forward us three tuning-forks, all employed in their establishment, each one being used for an especial purpose.[¶] The first, which is a quarter of a tone lower than that of Paris was, twenty-five or thirty years ago, that of the Philharmonic Society, of London. It has been judiciously preserved by Messrs. Broadwood, as one of the best suited to the voice, and it is by the extremely moderate *tone* it emits that they tune the pianos intended for accompaniments at vocal concerts. The second, much higher, since it is more elevated than our own, is that by which Messrs. Broadwood generally tune their pianos, because it is nearly conformable to that of harmoniums, flutes, &c.; it is the diapason of instrumentalists. Lastly, the third, still higher, is that now used by the Philharmonic Society. This extreme licence in the diapason[*] must be attended with inconvenience, and is calculated to endanger, in some measure, absolute correctness. The result is, that Messrs. Broadwood express a wish "for the success of our researches, so interesting and so important for the whole musical world."

M. Bender, musical director of the King of the Belgians and of the regiment of the Guides, would like two diapasons, with the difference of half a semi-tone; the higher one for military bands, and the other intended for theatres. M. Bender practises his system; the diapason employed by the bands of the Guides is not applicable to vocal music. It is the highest of all the diapasons we have received.

M. Dussoigne-Méhul, director of the Royal Conservatory at Liege, does not send us any tuning-fork, that which he employs being similar to that of Paris. He is one of the three correspondents who are in favour of the adoption of this diapason, as the extreme limit, and safeguard, if only, he says, to arrest its tendency to ascend.

M. Lubeck, director of the Royal Conservatory at the Hague, sends us his tuning-fork, which is somewhat less high than our own, and at the same time promises us his adhesion and support.[†] You see, Monsieur le Ministre, with how much sympathy and approbation your desire to establish a uniform diapason meets.

We have written to America. New York has not yet answered. M. E. Prévost, conductor of the French Opera at New Orleans, has forwarded us a letter of adhesion, and a tuning-fork which has not reached us.

We have also received information on the subject from distinguished artists in some of the great cities of France, where music is held in honour.

The tuning-fork sent us by M. Victor Magnien, director of the Imperial Academy of Music at Lille,[‡] is, after that of M. Bendor and those from London, the highest of any forwarded to us. It is, consequently, higher than that of Paris. It has, no doubt, like a good neighbour, experienced the influence of the band of the Guides at Brussels, and M. Magnien eagerly joins those who ask for a moderate diapason.

M. Mézerai, conductor of the orchestra at the Grand Theatre, Bordeaux, has communicated his diapason, which is less elevated than that of Paris. He first adopted the latter, but, he informs us, it fatigued his singers too much.

The diapason of Lyons is the same as that of Paris; that of Marseilles is a very little lower. M. Georges Hainl, conductor of the orchestra at Lyons, thinks the diapason of Paris ought to be retained, in spite of its high pitch, lest the *éclat* of the orchestra might be injured. M. Aug. Morel, director of the Communion School of Marseilles,[‖] inclines to this opinion. These two artists, with M. Méhul, constitute the group we have mentioned as proposing that the actual state of things should be adopted as the definitive limit.

Toulouse has forwarded us two tuning-forks, that of the theatre, less elevated than our own, and almost similar to that of Bordeaux, and that of the School of Music,[¶] which is about the fourth of a tone lower. This is a remarkable difference, and all the more important, as Toulouse is one of those towns distinguished for musical instinct, where singing is popular, and harmony abundant, and which, in all times, has supplied our stage with artists possessing melodious and sonorous voices.

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[*] Herr Franz Abt, Capellmeister of the Ducal Theatre, Brunswick.

[†] The A proposed by the meeting at Stuttgart was one of 880 vibrations. The present diapason of Paris is 896, and that of Berlin, one of 903.

[‡] Herr Franz Lachner, the cebrated composer, and director-general of music at the Bavarian Court, expresses himself in the following terms: "I warmly desire, for the interest of the art, that the Commission may happily surmount the difficulties which will, doubtlessly, arise in the execution of this project. Be assured that, as far as I am concerned, I will do all I can to realise your idea."

[‖] M. Coccia thinks that the Turin tuning-fork he sends us is also that of the theatre at Vienna. He believes it to be lower than that used at Venice and Naples.

[¶] These three forks give the C (*ut*), like that sent from St. Petersburg by M. Lwoff.

[*] There is about a semi-tone difference between Messrs. Broadwoods' diapason No. 1, and their diapason No. 3

[†] "I have had also to contend against the continual rise of the diapason. By founding a stable diapason you will render an important service to the art. I shall, therefore, do all in my power to bring into use among us the diapason you fix upon for France."—*M. Lubeck's Letter.*

[‡] A branch of the Imperial Conservatory of Paris.

[‖] The School of Marseilles, as well as the School of Toulouse, mentioned a few lines lower down, are branches of the Imperial Conservatory of Paris.

[¶] These two tuning-forks were sent us by M. Meriel, director of the School of Toulouse.

The tuning-fork of the School of Toulouse is, like that of the Grand-Ducal Theatre of Carlsruhe, from which it differs by only four vibrations, the lowest of all that have been forwarded us. That of the band of the Guides of Brussels, which emits nine hundred and eleven vibrations a second, is, for sharpness, the extreme limit of these diapasons; that of Carlsruhe, which gives only eight hundred and seventy vibrations, is the limit in lowness.* Within this difference, which is not much less than a semi-tone, range the diapasons in use at the present day, and, consequently, the orchestras, bands, and vocal combinations, of which they constitute the rule and the law, and of which, so to speak, they represent (*résumer*) the expression.

Thus France possesses, at her two extremities, one of the highest diapasons, that of Lille; and one of the lowest, that of the School of Toulouse. We can trace on the map the route followed by the diapason in France; it rises and falls with the latitude. From Paris to Lille it rises; it falls from Paris to Toulouse. We perceive that the North is subject to the contact, the predominance of instrumental, while the South remains faithful to the rules and good traditions of vocal art.

We have presented to you, Monsieur le Ministre, a faithful epitome of the information we have received; we have acquainted you with the impression it has produced upon ourselves. Taking into account the almost unanimous opinions expressed for a moderation of *tone*, and the unanimous opinions in favour of the adoption of a uniform diapason, that is to say, a general levelling of the diapason, freely consented to; taking into account the remarkable differences existing between the various diapasons we have been enabled to compare, differences measured, with all the precision of science, by the number of their vibrations, and duly marked down in one of the tables annexed to this report,† the Commission, after discussing the question, has adopted, unanimously, as principles, the following propositions:—

It is desirable that the diapason should be lowered.

It is desirable that the lowered diapason should be generally adopted as an invariable regulator.

III.

It now remained for us to decide how much the diapason could be lowered, so as to secure for it the best probable chance of being adopted as an invariable regulator.

It was evident that the greatest possible abatement was a semi-tone, a more considerable deviation being neither practicable nor necessary; and on this point the Commission was unanimous. The semi-tone, however, met with opponents, and three systems were started; the diminution of a semi-tone; the diminution of the fourth of a tone, and a diminution of less than the last.

One member only proposed a diminution of less than a quarter of a tone. Fearing especially that the relations of commerce would be disturbed, he proposed a very moderate diminution, which, at the most, and in its greatest amplitude, should extend to half a quarter of a tone.

The question of commercial relations is sufficiently important to warrant us in dwelling on it an instant. Besides, Monsieur le Ministre, when you appointed us you directed our attention to it.

Among the documents forwarded us is a letter signed by our principal and most celebrated instrument-makers in all branches of the profession. In this letter addressed to your Excellency, the writers state all the inconveniences resulting "from the continual rising of the diapason, and of the difference between various diapasons." You are asked to put an end to these inconveniences by establishing a uniform system of diapason. "It belongs to your Excellency," say the writers, "to cause this kind of anarchy to cease, and to render the musical world as important a service as that formerly rendered to the industrial world by a uniform system of measures."

The Commission entertains the highest consideration for the interests of our great trade in the manufacture of instruments, which is one of the sources of riches in France, a branch of industry intelligent in its products and felicitous in its results. The clever men who direct, and have raised it to the first rank, cannot question our solicitude; they know we are friendly towards a trade which supplies some of the members of the Commission with valuable and charming auxiliaries.

But, if among these makers, who have so well pointed out to your Excellency "the inconveniences resulting from the divergence and constantly increasing elevation," there are some who, as we have been informed, now apprehend "the inconveniences" resulting from the measures we desire to adopt for the purpose of contenting them, what is to be done? Since, "with all the musical world," they have asked for a uniform diapason, how can the selection of a diapason, destined as we and they hope, to become uniform, disturb "commercial relations" already disturbed, in their opinion, by the divergence of existing diapasons from each other. The establishment of a uniform diapason necessarily implies the selection of one diapason and no more. Now we have received, listened to, compared, and measured twenty-five different tuning-forks, all in active use at the present day. From so many A's, which is to be chosen? Our own apparently. But why? Of these twenty-five diapasons, not one desires to rise, but many are eager to descend, while fifteen are lower than that of Paris. By what right should we say to these fifteen diapasons—Rise to our level. Would not the very fact of our doing so cause commercial relations to run a great chance of being disturbed? Is it not more logical, more reasonable, and more sensible, for the sake of the grand system of conciliation we wish to try, to descend towards this majority, and have we not, by this plan, the greatest chance of being listened to by the foreign artists whose assistance we have requested, and whom we now thank for having responded to our appeal with so much cordiality and sympathy?

In order to give the instrument-trade a mark of its solicitude, the Commission called together the principal makers, those who obtained the first rewards at the Universal Exposition of 1855, that is to say, the very same who wrote to your Excellency,* and it was only after conferring with them, and several of our orchestral conductors,† that the Commission deliberated on the extent the diapason might be lowered.

In the discussion on this point, the great majority of the suffrages was for the diminution of a quarter of a tone; this would sensibly moderate the trouble attending the studies and exertions of singers, and thus insinuate itself, so to speak, incognito, into the presence of the public, without causing too great a perturbation in established habits; it would facilitate the execution of ancient master pieces, and would bring us back to the diapason employed about thirty years ago, the period of the production of works of which most have remained on the repertory, and which would thus be in the position they occupied when composed and first represented. It would be accepted abroad more readily than the diminution of a semi-tone.* Thus, moreover, it would nearly approach the diapason selected in 1834, at Stuttgart. It already had in its favour actual experience, restricted, it is true, but the results of which we are able to appreciate.†

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* The diapason No. 1. of Messrs. Broadwood (the old diapason of the London Philharmonic) is rather lower than that of Carlsruhe, giving only 868 vibrations. M. Jos. Strauss, ducal Capellemeister, at Carlsruhe, states, while giving us his adhesion, that the diapason he employs is that which fatigues his singers, both male and female, the least, and is best adapted for the execution of operas, ancient as well as modern.

† Table A. Table B shows the progressional elevation of the diapason in different countries. These two tables were drawn up by MM. Despretz and Lissajous, members of the Commission.

* MM. Triébert, Buffet, and Ad. Sax, makers of wind-instruments; M. Cavaillé-Coll, organ-builder; the representative of M. Erard; MM. Pleyel-Wolff and Henry Herz, piano-forte makers; M. Alexandre, maker of the organ-melodium; and M. Willaume, maker of stringed instruments.

† M. Girard, conductor at the Imperial Academy of Music; and at the Société des Concerts du Conservatoire; M. Mohr, band master of the Imperial Guard; and M. Delaffre, conductor at the Théâtre Lyrique.

The Commission has, therefore, the honour to propose that your Excellency should institute a uniform diapason for all the musical establishments of France, and decide that the tuning fork giving the A should be fixed at 870 vibrations a second.

With regard to the measures to be taken for the adoption and preservation of the new diapason, the Commission is of opinion, Monsieur le Ministre, that it would be advisable:—

1. That a model tuning-fork, giving 870 vibrations a second, at a temperature of 15 degrees centigrade, should be constructed under the direction of competent persons, named by your Excellency.

2. That your Excellency should fix, for Paris and the departments, an epoch after which the new diapason should become obligatory.

3. That the state of the tuning-forks and instruments in all theatres, schools, and other musical establishments, should be submitted to the inspection of proper officers (*à des vérifications administratives*).

We trust, Monsieur le Ministre, that, for the sake of unity of the diapason, and to render these measures as comprehensive as possible, you will kindly exert yourself with his excellency the Minister of War, to procure the adoption of the diapason, thus amended, into the regiments of the army, and with his Excellency the Minister of Commerce, in order that, for the future, musical instruments made in conformity with this diapason may alone be admitted to contend for the prizes offered at the Industrial Expositions. We solicit, also, your Excellency's intervention, so that this diapason may be the only one authorised and employed in all the Communal Schools of France where music is taught.

Lastly, the Commission requests, Monsieur le Ministre, your kind intervention with his Excellency the Minister of Public Instruction and Worship, in order that, for the future, the organs he may order to be built or repaired may be tuned according to the new diapason.

Such, Monsieur le Ministre, are the measures which strike the Commission as necessary, in order to secure and consolidate the success of the change that the adoption of a uniform diapason would introduce in our musical habits (*mœurs musicales*). Order and regularity would be established where chance, caprice, and carelessness now sometimes reign; the study of singing would be pursued under more favourable circumstances; and the human voice, having its ambition less excited, would be subjected to less rough trials. The instrument trade, by aiding in these measures, might, perhaps, be enabled to improve still more its products, already in such request. It is not unworthy the government of a great nation to busy itself with questions of this kind, which may appear futile, but which possess a real importance of their own. Art is not indifferent to the care taken of it. It requires to be loved, in order to fructify and spread, and elevate the hearts and minds of men. Everyone knows with what love, with what ardent and rigorous uneasiness the Greeks, who were animated by so lively and profound a sentiment of art, watched over the preservation of the laws regulating their music. By directing your attention to the dangers to which an excessive love of sonority may expose musical art, and by endeavouring to establish a rule, a measure, a principle, your Excellency has a afforded a fresh proof of the enlightened interest you take in the fine arts generally. The friends of music thank you, Monsieur le Ministre—those who have devoted to it their whole life as well as those who dedicate to it their leisure moments; those who speak the harmonious language of tune, as well as those who merely understand its beauties.

We have the honour respectfully to remain,
Monsieur le Ministre,
Your Excellency's very humble and very devoted Servants,
J. Pelletier, President; F. Halévy, Reporter; Auber, Berlioz, Despretz, Camille Doucet, Lissajous, General Mellinet, Meyerbeer, Ed. Monnais, Rossini, Ambroise Thomas.

The Minister of State has resolved as follows:—

Considering the order, bearing date the 17th July, 1858, and appointing a commission charged to investigate the means of establishing in France a uniform musical diapason, of fixing on a sonorous standard which might serve as an invariable type, and of indicating the measures to be taken for securing its adoption and preservation;

Considering the report drawn up by the Commission, and dated the 1st February, 1859;

It is decreed that:—

Art. 1.—A uniform diapason is fixed for all the musical establishments in France, Imperial and other theatres of Paris and the departments, conservatories, branch schools, and public concerts authorised by the State.

Art. 2.—This diapason giving the A adopted for tuning instruments, is fixed at eight hundred and seventy vibrations a second. It will be known by the name of the *Normal Diapason.*

Art 3.—The standard prototype of the Normal Diapason will be preserved at the Imperial Conservatory of Music and Elocution.

Art. 4.—All music establishments authorised by the State will have to be provided with a tuning-fork, verified and stamped in conformity with the standard prototype.

Art 5.—The Normal Diapason will come into force, in Paris, on the 1st of July next; and, on the 1st of December following, in the departments.

After the above dates only instruments verified and stamped in conformity with the Normal Diapason will be admitted in the musical establishments above mentioned.

Art. 6.—The state of the tuning-forks and instruments will be regularly submitted to the examination of the proper officers (*à des vérifications administratives*).

Art. 7.—The present decree will be lodged with the Secretary-General, to be notified to all whom it may concern. Achille Fould.

Paris, 16th February, 1859.

Tables annexed to the Report.

TABLE A.

Table of the diapasons used in the principal towns of France, and in various countries of Europe, according to the types received by the Ministry of State:

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* Being convinced of the utility of your project, I will do my best to get your diapason accepted here, if, after the researches of your Commission, the change to be made is not too great." Letter from Herr Ferdinand David, Director of the Conservatory, at Leipsic.

† The Grand-Ducal Theatre, at Carlsruhe, and the School of Toulouse, the voices from which are fresh, supple, and in good condition, employ the diapason which we propose. With reference to this school, by the way, we must remark that young pupils from it experience serious difficulty, and sometimes a perceptible deterioration of voice, when they are obliged to exchange their own moderate diapasons to conform to that of Paris.

Origin	Number of vibrations per second.	Variation from the diapason of the Opera at Paris. Measured in vibrations.	Variation from the diapason of the Opera at Paris. Measured in vibrations of mean tone.
	France.		
Lille	904	+8.0	+0.077
Paris	896	...	...
Marseilles	894	— 2.0	—0.019
Bordeaux	886	—10.0	—0.096
Toulouse (Theatre)	885	—11.0	—0.106
Toulouse (Conservatory) ...	874	—22.0	—0.210
FOREIGN COUNTRIES.			
Brussels (Band of the Guides)	911	+15.0	+0.144
London (No. 3)	910.3	+14.4	+0.138
,, (No. 2)	905	+ 9.0	+0.087
Berlin	903.5	+ 7.5	+0.072
St. Petersburg	903	+ 7.0	+0.067
Prague	899.5	+ 3.5	+0.034
Leipsic	897.5	+ 1.5	+0.014
Munich	896.2	+ 0.2	+0.002
The Hague	892.3	— 3.7	—0.035
Pesth	892	— 4.0	—0.038
Turin	889.5	— 6.5	—0.062
Wurtemburg			
Weimar			
Brunswick	887	— 9.0	—0.086
Gotha	886·5	— 9.4	—0.091
Stuttgardt	886	—10.0	—0.096
Dresden	882	—14.0	—0.134
Carlsruhe	870	—26.0	—0.520
London (No. 1)	868	—28.0	—0.269

TABLE B,

Showing the progressive elevation of the diapason in different countries :

Names of the Observers.	A.D.	Number of Observations.	Variation from the actual diapason of each country in fractions of the mean tone.
	Paris (Grand-Opera).		
Sauveur	1699	808	—0.845
do.	1700	808	—0.845
do.	1704	810·6	—0.820
do.	1713	811.7	—0.809
Drouet............	1810	846	—0.480
Fischer	1823	862.7	—1.320
Drouet............	1830	871.5	—0.235
Delazenne ...	1836 to 1839	882	—0.134
Lissajous.........	1858	896	
	Berlin.		
Marburg	1752	843.75	—0.574
Wieprecht ...	1806 to 1814	861	—0.408
Fischer	1823	874.64	—0.277
Wieprecht	1830	880	—0.225
Schribler.........	1834	883.25	—0.194
Wieprecht	1858	903.5	
	Saint Petersburgh.		
Sarti	1796	872	—0.298
Lissajous.........	1858	903	
	Turin.		
Delezenne	1845	880	—0.091
Lissajous.........	1858	889.5	
	Milan.		
Delezenne	1845	893.14	—0.072
Lissajous...... ..	1856	900.6	

ALUMINIUM.

M. Christofle has communicated to the Academy of Sciences at Paris, in the form of a letter to M. Dumas, the result of some experiments made with aluminium bronze. He says :—" We have applied the bronze of aluminium to two uses, for which its qualities of hardness and tenacity seemed specially fitted. The success has been quite equal to our expectations. The first is in the construction of bearing surfaces for rotating axles; the second for slide valves and other bearing surfaces exposed to much friction. Of these applications the following are examples :—The journals for the axle of a polishing wheel, making 2,200 revolutions per minute, were made of aluminium bronze eighteen months ago; they have lasted to the present time. Other bearing surfaces under similar conditions do not last more than three months. Again, the slide bars of a sawing machine, the saw moving with the velocity of 240 revolutions per minute, were made of aluminium bronze. It has been used now one year without any apparent trace of wearing out. Slide bars of ordinary bronze would not, under similar circumstances, have lasted four months. The second application of the aluminium is for the manufacture of ordnance, gun-barrels, howitzers, and firearms. A pistol-barrel having been constructed of it in our manufactory, it was tried in the practice-ground of Renette, and was subsequently forwarded to the exhibition at Dijon. It was subjected there to every kind of test, in the presence of the jury; it bore them to the utmost of our expectations.

" We do not wish it to be imagined that this trial of a pistol-barrel can prove conclusively the value of the metal for ordnance, but the comparative experiments made by us between this metal, bronze, iron, and steel, have demonstrated its immense superiority over the others. So strong is our conviction on this point that we have requested the Academy to support our application to the Minister-at-War to be permitted, at our own expense, to make such a piece of artillery as may be thought most proper for testing the properties of aluminium bronze as a metal for guns. We look for great results in this direction, which we shall feel proud to associate with our name, at the same time rendering thanks to M. Saint Clair Deville, to whom is due the discovery of those alloys for which there appears so brilliant a future.

" The large bar deposited in the office of the Academy is intended to be forged and bored for a minié rifle. The small bar has already been forged, at a cherry heat, when it works like steel of the best quality, whilst it is well known that ordinary bronze is brittle when heated."

M. Christofle's letter was referred to the examination of a committee, composed of Marshal Vaillant and Messrs. Piobert and Morin.

AUSTRALIAN WINES.

The following is extracted from the *Adelaide Observer:—*

The rapid development of the wine growing interest in Australia is indicated by the fact of movements taking place both in this colony and in Victoria for the formation of companies having in view the manufacture and sale of the produce of the vineyard. The East Torrens Wine-making and Distillation Company, as our readers are aware, are preparing on a moderate scale to commence operations this year, a sufficient amount of capital having been raised to warrant the erection of buildings, and to justify the shareholders in the hope that when once the Company have fairly started the public may be induced to give the undertaking more extended support. At present the limited means of the Company is a great disadvantage, the number of £5 shares taken up being only 257 out of the 400 offered for sale. From this it would appear that vine-growers are not yet generally impressed with the desirability of combination, and that they prefer making use of their produce themselves to selling it to a company. Were it not so, it is clear that such persons might have subscribed the capital called for without inconvenience. It is possible that in thus neglecting an opportunity of joint effort they may be ultimately prejudicing their own interests, for it is certain that some united effort will have to be made before our wines can be expected to produce an impression upon consumers in the home market, or before we can obtain the name *par excellence*, of a wine-producing country. However, if the vine-growers respectively feel that they can sell their own produce advantageously, either in the colonies or abroad, it is not likely that they will look to a company to purchase their grapes. Large quantities of wine are now sold yearly to colonial consumers at five or six shillings a gallon, and as long as the owners of a few acres of vineyard can dispose of their produce in this way, they will probably do so. The Company seem to feel this. Having no vineyards of their own they depend for supplies of grapes upon the general growers, who are every year manufacturing more and more for themselves. The report of the Company, therefore, appeals to the grape-growers, and reminds them that success " depends in some degree on the encouragement" given by them. But it is not likely that growers will sacrifice profits for the sake of helping the Company. They will, no doubt be glad to sell their grapes if they can get more for them than by converting them into wine. But will the Company be able to give such a price ? Will they, in fact, without vineyards be able to make wine as cheaply as persons having vineyards? This is the difficulty which any mere manufacturing company will have to contend with so long as the produce of our vineyards is not much in advance of colonial consumption, and is independent of distant markets.

In Victoria we find that a Vineyard Association is proposed to be formed for both growing grapes and making wine. Maldon is the locality chosen for the operations of this Company, whose capital is intended to be obtained by the issue of 2,000 shares at £5 each. A large profit is counted upon, we observe, by the sale of grapes simply, 4d. a pound being calculated upon in the prospectus as the price to be realised. The *Border Post*, however, goes beyond this. The writer of the article in that journal bases his estimate upon the grapes being sold at 1s. a pound. He says that such is the price at Albury, and that they have never been sold for less than 10d. a pound wholesale. According to this it would not pay to make wine at all; but the writer allows for a decrease in price being produced by regular supplies, though he still maintains that grapes need never be retailed so low as 6d. a pound, since colonial wine has been sold in London at £2 2s. a gallon! This, our readers will see, is about six or seven times the price that ought to be counted upon as the market value of our wines in England.

The Victorian Company are right, we think, in their proposal to grow vines as well as to manufacture wine. In this colony a good start has been obtained over our neighbours in the planting of vineyards; it is our own fault if we allow them to come up with us. The formation of of wine-making companies, however, whilst, in our opinion, necessary to the establishment of a foreign trade, may be regarded as premature by those who believe that our grape crops are not yet large enough to necessitate the manufacture of wine for export, and that the internal demand has yet to be greatly increased. At all events; a company resolved to obtain a name for its wines in the English market must be prepared for great exertion and some risk. A letter which we published some time ago from a firm at home spoke of our best wines being saleable at six or seven shillings a gallon. Probably, our best wines have not yet been tasted by that firm, or they would come to a conclusion that, for the present at least, a higher price was likely to be obtained for them in the English market.

With regard to the question of external markets for our wines, we are surprised that Mauritius has not been tried. The taste for light wines, such as we can well produce, is greater there amongst the French creole population than in England, where full-bodied port and sherry are most sought after. Mauritius, moreover, is near at hand, and could, therefore, be supplied by us at rates much lower than they have at present to pay for the wines of Europe. And we might also try India as a market. In Victoria it was suggested at a recent meeting of the Philosophical Society that colonial wines should be admitted free of duty, in order to encourage the consumption of so wholesome a drink.

SCIENTIFIC AND TECHNICAL TEACHING.

The following is extracted from Baron Von Liebig's " Letters on Modern Agriculture ":—

The technical part of an industrial pursuit can be learned; principles alone can be taught. To learn the trade of husbandry, the agriculturist must serve an apprenticeship to it; to inform his mind in the principles of the science, he must frequent a school specially devoted to this object. It is impossible to combine the two; the only practicable way is to take them up successively. I formerly conducted, at Giessen, a school for practical chemistry, analysis, and other branches connected therewith, and thirty years' experience has taught me that nothing is to be gained by the combination of theoretical with practical instruction. A student of chemistry who attends the lecture-room and the laboratory concurrently positively defeats thereby the object of his stay at the school, and misses the aim of his studies. It is only after having gone through a complete course of theoretical instruction in the lecture-hall that the student can with advantage enter upon the practical part of chemistry; he must bring with him into the laboratory a thorough knowledge of the principles of the science, or he cannot possibly understand the practical operations. If he is ignorant of these principles, he has no business in the laboratory.

In all industrial pursuits connected with the natural sciences, in fact, in all pursuits not simply dependent on manual dexterity, the development of the intellectual faculties, by what may be termed " school learning," constitutes the basis and chief condition of progress and of every improvement. A young man with a mind well stored with solid scientific acquirements, will, without difficulty or effort, master the technical part of an industrial pursuit; whereas, in general, an individual who may be thoroughly master of the technical part is altogether incapable of seizing upon any new fact that has not previously presented itself to him, or of comprehending a scientific principle and its application.

I have often found that students coming from good colleges will speedily leave the pupils of industrial and polytechnic schools far behind them even in the natural sciences, though the latter, when compared with the former, were at first giants in knowledge.

APIARIAN SOCIETY.

The first meeting of this newly formed society was held on Wednesday evening, 25th ult., at the rooms of the Entomological Society, Bedford-row, the Rev. S. Waud in the chair. The report stated that an experimental apiary had been established, and placed under the care of the secretary, at Muswell-hill, to which the public were admitted by member's orders. Mr. Shirley Hibberd stated that numerous donations of books had been received for the library, and that it was the intention of the committee to institute lectures on improved methods of bee keeping, and also to offer prizes to cottagers for the best examples of bee management. Mr. Tegetmeier described an entirely novel method of bee keeping adopted in America, which the society were about to test at their apiary. Specimens of artificial comb, and various models, apparatus, &c., were exhibited.

SUPPLY OF COAL.

M. de Carnal, one of the greatest owners of coal mines in Prussia, in a statistical work on coal digging, states that the quantity of coal dug in 1857 amounted to 125,000,000 of tons, a mass which piled up 6 feet high, would cover a geographical square mile. The lands from which the coal is procured may be estimated at 8,000 square miles, and the mean depth of the beds of coal at about 31 feet. The mass of coal then known to exist would form a cube of 10 miles. If we compare this enormous bulk of coal with the quantity annually consumed, we may confidently affirm that there is enough to last for 36,000 years. The calculation of 31 feet for the mean depth of the beds is perhaps too low, for the coal fields of Liège extend 55 feet, those of Staffordshire to 151 feet, and those of Ruhr to 134 feet. The coal dug in 1857 amounted in value to £37,500,000 sterling, a sum far beyond that realized by the digging of the precious metals. In England some calculations have been made with regard to the yield of coal in our own country, according to which the coal fields of Great Britain yield 63,000,000 tons of coal per year. A better idea of the immense commerce of England could not be formed than by stating the fact that at Manchester and its environs a motive steam power equal to 1,200,000 horses is constantly maintained, to support which there are consumed 30,000 tons of coal per day, or 9,500,000 a-year. In the manufacture of salt alone about 3,000 tons are consumed per day, or 950,000 a-year. The Transatlantic steamers from Liverpool and other ports consume 70,000 tons per year, and the manufacture of gas absorbs 10,000,000 tons per year. The export of coal from England reached in 1858, 6,078,000 tons. It is estimated that England alone could furnish enough coal for the consumption of the whole of Europe for 4,000 years.

DISTRICT EXHIBITION OF INDUSTRIAL PRODUCTS AT ROUEN.

An Exhibition is about to be held at Rouen, under the auspices of the "Société libre d'émulation du Commerce et de l'Industrie de la Seine-Inférieure." The Exhibition opens on the 15th June, and remains open two months. The following are the Departments of France whose products will be included in the Exhibition:—

Nord, Pas de Calais, Aisne, Oise, Somme, Seine-Inférieure, Eure, Calvados, Orne, Manche, Mayenne, and Sarthe.

The Society, in its programme, particularly recommends, in order that the Exhibition may truly represent the actual condition of the industry of the district, that the articles exhibited should not be exceptional productions manufactured for the occasion.

Home Correspondence.

EXHIBITION OF 1861.

Sir,—It is with great regret that I hear of the non-ability of the committee selected on the project of Decennial Exhibitions to proceed with the undertaking. I think still an endeavour ought to be made; let those who are willing to exhibit have an opportunity. The high patronage that an Exhibition would receive must ensure the success of the undertaking as regards the monetary view of the matter.

It is not so much with foreigners that we have to compete as among ourselves. The public must be made able to discriminate artistic design and good workmanship from bad; not to be led away by the "puff" of advertisements, or gulled into paying an exorbitant price because a house, from position and long standing, enjoys a reputation.

A decennial Exhibition would but act as a mirror, wherein the promoters of industry would find themselves truthfully and honestly reflected. The good article at a fair price would there be presented solely upon its merits.

To my way of thinking, Sir, Exhibitions of Art *ought* to be represented, and never at a more lengthened period than ten years, for the mind naturally becomes contracted upon ideas of good taste, to be expanded only by frequent stimulants in the form of new designs and inventions.

It is not to the manufacturers, who are already in possession of notoriety, that your committee should address itself, but to those who are diligently seeking to obtain it; for it is certain that the former, *until they are absolutely forced*, will never (but in self-defence) lend their aid and capital towards promoting an Exhibition that might, more or less, injure themselves.

It is in creating a healthy free-trade rivalry among shop-keepers that the public will reap an advantage. The country will secure for itself pre-eminence for its style of manufacture, and the Society of Arts will receive that praise so justly due to them for always furthering the interests of commerce.—I am, &c.,

RICHARD A. GREEN.

ROYAL ACADEMY OF MUSIC.

Sir,—I observed that at a meeting of the Society of Arts, on the 11th inst., a paper was read on the "Recognition of Music as an Art," followed by a discussion, when certain remarks and accusations of no trifling character were brought forward against the Royal Academy of music, of which I have been Principal since the retirement of Dr. Crotch from that position in June, 1832. This discussion took place without any intimation being given to myself or any of those professors connected with the Academy, since the invitations were sent so late that it was impossible for them to attend the discussion.

I was astonished at the assertion that not one single Artist capable of doing England or the Academy of Music credit before the public, had issued from the Academy during the last twenty years. Now I beg to state that the numerous talented students who have appeared during that period renders this assertion most unjust and injurious to many talented individuals well known to the public.

It has been the misfortune of this academy, and not its fault, that it has not received such support from the Government of this country as is extended to similar institutions in other countries, which has enabled them to give greater extension to native artists.

106 pupils have been educated gratuitously, and 258 received on moderate terms; if the applications for a grant from Government had been attended to, many more persons of talent would have been educated gratuitously, or on very reduced terms.

I am, &c.,
CIPRIANI POTTER,
Principal of the Royal Academy of Music.

May 26th, 1859.

THE RELATIVE VALUES OF COAL AND COKE FOR LOCOMOTIVE ENGINES.

Sir,—In reading your report of the discussion on Mr. Fothergill's paper in the *Journal* of May 20, I went quite along with Professor Wilson, when he remarked that "he could not understand how coal containing 2 per cent. of ash could be converted into coke containing 7 per cent. of ash, when only 1½ parts of coal went to make one part of coke;" and I was, therefore, glad to observe in the *Journal* of May 27 a letter from Mr. Dugald Campbell, because I hoped to discover in it some explanation of so wonderful a result. I was much disappointed to find no attempt at an explanation of this, but merely a statement that the experiments had been carefully conducted and repeated, and an expression of an apparently confident opinion that neither the experiments nor the conclusions deduced from them were open to challenge. As the subject is one of great importance, Mr. Campbell allowing that "were it not for the increase of the ash there would not be so very much difference" in the heating powers of the coke and of the coal from which it was made, while according to his analyses, he makes the heating powers of the coke only 12·78 and that of the coal as high as 15·18, I think the analyses which bring out such results ought not to be allowed to pass without a searching investigation, and will therefore shortly state what occurs to me on the subject, in the hope that some useful light may be thrown upon it by the discussion which it may receive.

It will not be denied, I suppose, if ash be found in the coke it must have existed in some form or other in the coal from which it was made. Further, it is not disputed that in the case in question, 1½ parts of coal went to make one part of coke; that is to say, for every 150 parts of coal which went into the coke-oven 100 parts of coke came out. What, then, according to Mr. Campbell's calculations, would 150 parts of Ramsay's coking-coal have yielded upon analysis? The analysis in 150 parts is as follows:—

Carbon	128·355	Sulphur	2·190
Hydrogen ...	8·520	Moisture	1·110
Oxygen	4·605	Ash	3·000
Nitrogen	2·220		

Mr. Campbell states the following to be a correct analysis of the 100 parts to be yielded by the 150 parts of coal.

Carbon	86·91	Sulphur	1·94
Hydrogen	1·32	Moisture	1·28
Oxygen	0·10	Ash	7·65
Nitrogen	0·80		

He then goes on to say that this very much higher amount of ash is caused by an excess of iron and silica principally. I shall assume that all the ash contained in the 150 parts of coal is found in the 100 parts of coke. This would make the amount of ash in the coke 3 per cent., and I have simply to ask where the remaining 4·65 per cent., consisting "of iron and silica principally," came from. It seems to me perfectly plain that there must be a mistake somewhere, either in the analysis of the coal or in that of the coke, and that one or other of the two following conclusions is unavoidable,—either that Mr. Campbell, in his analysis of the coke, mistook for iron or silica or other ash what was in reality carbon, or, if 7 per cent. of iron and silica and other ash really existed in the coke, then that 7 parts, at the least, of iron and silica and other ash must have been in the 150 parts of the coal. In either case I am entitled, on Mr. Campbell's own showing, to claim for the coke nearly the same heating power, weight for weight, as the coal would give, instead of a heating power only in the proportion of 12·78 to 15·18. From a passage in Mr. Campbell's report, I am inclined to think that the error is in the analysis of the coal. He there says, "I can only account for this increase in these two substances (iron and silica in the ash of the coke) from their being volatilised in the coking ovens and entering into the crevices of the fuel from which the gases escape." From this I infer that the analysis of the coal not having been conducted in such close vessels as coke ovens, a large amount of the iron and silica had been volatilised and escaped without being observed. This seems to me sufficient to solve the difficulty; at all events I submit it to the readers of the *Journal* as a contribution towards its solution.

I have only further to ask whether it is quite fair to state the per centage of moisture in the coal at 0·74, while that in the coke is stated as high as 1·28?

I am, &c., I.

Edinburgh, May 28, 1859.

Proceedings of Institutions.

Glasgow Institution.—The first annual meeting of this Institution was held on Wednesday, May 25th, David Smith, Esq., J.P., in the chair. It is formed on the self-supporting principle, and the report showed that, whatever may be its future fate, it has made a fair beginning. The evening classes hitherto opened have been in the following subjects:—Mathematics, Geography, Drawing, Latin and Greek, French, Grammar, Composition, and Logic; Writing, Arithmetic, and Book-keeping; Phonography and Reporting; Gaelic; Music; and Elocution; Political Economy, and Mutual Instruction. The most of these classes were opened only at the beginning of the winter session, but taking the whole year, from June 2nd to May 10th, the aggregate number of separate individuals who entered them has been 370; average to each class, 42, for many attended more than one; day juvenile and advanced classes, 217, making a total of 587 individuals who have entered during the year. The number at present enrolled for the summer session is, evening classes, 144,; day classes, 127—total, 271, conducted by a staff of 132 teachers and assistants. The Institution having been placed in union with the Society of Arts, as many came forward for examination as could have been expected in the infancy of the Institution—namely, four. The income and expenditure have been £246 8s. 2d.; the latter being, for rents, taxes, advertising, and expenses, £77 3s. 2d., and the balance, teachers' salaries in proportion to their classes. The report also stated that earnest endeavours are making to form a library, which it is expected will be realised during the year. One peculiarity of this Institution in regard to stimulating students and scholars, is, that it does not recognise prizes given to the best, second-best, &c., as beneficial in general classes, but rather the reverse, as the managers entertain the opinion that it is commonly the simply clever youth who gains them, to the exclusion of the less gifted but more diligent student. Instead of that principle, a certain pretty accurate degree of proficiency is fixed in each branch studied, and every student or scholar who, on individual examination, is found to reach or surpass that point, is entitled to a certificate of the same, signed by the teacher. Tangible prizes could be attached to the certificates on this principle as well as on the other, but they have been regarded as not only unnecessary, but as tending to no real advantage to the student. Thirty-six of these certificates were handed to successful candidates by the chairman, and after a resolution that the Institution is well worthy of the patronage of the public, votes of thanks to the local board, the teachers of the Institution, and to the chairman, the meeting, which was well attended, separated.

Swan River (Western Australia) Mechanics' Institute.—The eight annual report of this Institute, for the year 1858, was reeently presented to the annual meeting, at which the Governor of the Colony was present. The committee state that the success which has attended the operations of the Institute during the past year has been as marked as the most sanguine could have anticipated. The library now numbers 1,400 volumes. Among this large collection will be found many standard historical, scientific, and mechanical works, as well as others of a generally light and entertaining character. The number of books issued during the past year was 2,605, being about 1,000 more than were delivered during the preceding year. This great increase is in some measure to be attributed to the large number of honorary members who now avail themselves of the use of the library. Some five or six hundred volumes of new works have been ordered. To T. Helms, Esq., thanks are particularly due, for his gift of 42 volumes of the Waverley Novels. The number of members on the books of the Institute is 130. The discussion class, which is found to be one of the greatest incentives to reading and general improvement that has as yet been devised, has not been carried on quite so successfully during the past year. A music class has been established, under the leadership of Mr. S. T. Mitchell, and it is anticipated that ere long a good band will be formed in connection with the Institute. The establishment of a museum has, at all times, occupied the most earnest attention of the committee, and although up to the present time their exertions have not been crowned with success, for want of a suitable room in which to exhibit, they are still keeping this object in view, believing it would not only prove most beneficial to the Institute itself, but also to the colony in general. The lectures which were delivered during the past year were, on all occasions, numerously attended by a respectable and attentive audience. The financial position of the Institute is satisfactory. The receipts last year amounted to £137 13s., and the expenditure to £133 13s., leaving a balance to the credit of the Institute of £4 5s.; whilst independently of the £50 voted by the local government, which the committee are desirous should be annually devoted to the purchase of books and instruments, the amount of ordinary and honorary members' subscriptions has been found sufficient to cover the current expenses. The committee conclude their report by returning special thanks to their patron, the governor, and to the hon. the legislative council, for their kind and liberal support.

To Correspondents.

Errata.—In last number of the *Journal*, p. 481, col. 1, line 38, for "rough" read "angle;" line 3 from bottom, for "Badium," read "Budrum." col. 2, line 21, for "rollers," read "rules;" line 33, for "arrange," read "arouse."

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Royal Inst., 2. General Monthly Meeting.
Entomological, 8.
Tues. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Photographic, 8.
Wed. ......Literary Fund, 3.
Meteorological, 7. Anniversary.
R. S. Literature, 8½.
Archœological Assoc., 8½.
Thurs .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Royal Soc. Club, 6.
Antiquaries, 8.
Philological, 8.
Fri. ......Astronomical, 8.
Royal Inst., 8½. Prof. Tyndall, "On the Transmission of Heat of different qualities through Gases of different kinds."
Sat..........Royal Inst. Mr. J. P. Lacaita, "On Modern Italian Literature."
Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, May 20th*, 1859.]

Dated May 11th, 1859.

1181. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved burling and napping machine. (A com.)
1183. M. Henry, 84, Fleet street—A mode of protecting the mariner's compass against local attraction. (A com.)
1185. W. Spence, 50, Chancery-lane—Imp. in knapsacks and other military equipments. (A com.)
1187. J. Leadbetter, Leeds, and J. Rhodes, Armley, near Leeds—Imp. in pumps.

[*From Gazette, May 27th*, 1859.]

Dated 31st March, 1859.

808. D. B. White, Newcastle-upon Tyne—An improved indicating gauge lead or plummet.

Dated 23rd April, 1859.

1012. H. Keach and G. H. Farrington, Bush-lane, London—Improved advertising circulars.

Dated 12th May, 1859.

1189. D. Foxwell, Manchester—Imp. in sewing machines, and apparatus connected therewith.
1193. T. R. Oswold, Sunderland—Imp. in building ships and other vessels.

Dated 13th May, 1859.

1195. J. Woodley, Church-row, Limehouse—Imp. in sawing machines.
1197. W. Clark, 53, Chancery-lane—Certain imp. in knitting machines. (A com.)
1199. W. Whitehouse, New Ferry, near Birkenhead, Chester—Imp. in steam vessels.
1201. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith, Liverpool—Imp. in the manufacture of bread, biscuits, and like articles, and in the machinery and apparatus connected therewith.
1203. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in machinery or apparatus for treating india rubber and other similar gums. (A com.)
1205. J. T. Beale, Greenwich, Kent, and T. N. Kirkham, Upper Halliford, Middlesex—Imp. in the preparation of colours for dyeing and printing.

Dated 14th May, 1859.

1207. J. M. Munro, Bristol—Imp. in the manufacture and arrangement of chain harrows.
1209. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in dyeing. (A com.)
1211. T. Cooper and T. J. Evans, West Bromwich, Staffordshire—A new or improved oven or stove for baking, for drying japanned and lacquered goods, and for some other purposes as the same is or may be applicable to.
1213. J. Chatterton, 7, Devonshire-street, Islington—Imp. in covering wires and other metal conductors for telegraphic purposes.

Dated 16th May, 1859.

1215. E. Adams, Stanton Iron Works, Derby—The employment of machinery for drawing or extracating the gas flames or smoke from furnaces, and forcing the same into them, or into the cupola, to be used as blast or fuel for melting iron or mines of any description.
1217. J. Jones, Dorstone, Hereford—Imp. in musical instruments.
1219. G. Allcraft, Upper Thames-street—Imp. in pressure guages.
1221. W. E. Newton, 66, Chancery-lane—Imp. in manufacturing instruments for sharpening knives. (A com.)

Inventions with Complete Specifications Filed.

1249. G. R. Sampson, Massachusetts, U. S.—A new and useful improvement in propelling navigable vessels through water. (A com.)—May 20th, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, May 27th*, 1859.]

May 27th.

2696. J. Ramsbottom.
2704. S. Diggle.
2706. L. A. Possoz.
2707. G. Oates.
2710. G. Collier and W. Noble.
2712. G. Hadfield.
2713. W. Parsons.
2714. C. Hancock.
2716. W. A. Henry.
2729. J. Thow and T. M. Hall.
2733. J. Colyer.
2734. J. Coulson.
2740. R. Laming.
2770. H. Bevan.
2788. J. G. Arnold.
2795. F. W. Fletcher.
2831. B. Lauth.
2863. G. W. Baker.
2892. J. J. Aston.
2925. W. Spence.
3007. J. H. Johnsen.
80. C. M. Kernot.
155. R. Bradley and W. Craven.
209. W. C. Homersham.
222. H. Owen.
809. S. S. Bateson.
819. W. E. Newton.
821. W. Tod.
849. G. Haseltine.

[*From Gazette, May 31st*, 1859.]

May 30, 1859.

2739. T. P. Purssglove.
2742. J. Samuel.
2743. E. Viney.
2744. H. Adcock.
2745. F. Warner, J. Derbyshire, and A. Mann.
2748. S. Newington.
2760. G. Spiller.
2772. R. Legg.
2777. T. Sibley.
2806. W. Burness.
2818. H. Meidinger.
2828. J. Wilson.
2833. J. Lightfoot.
2838. W. Beardmore.
2840. G. W. B. Kiallmark, and W. T. Timewell.
2842. J. B. Guthrie.
2860. E. Bow.
2873. J. Bullough.
2875. W. Clark.
2891. W. Clark.
2899. J. Aitken and J. Brooks.
2901. A. Mitchel.
2916. A. S. Beliard.
544. J. Pile.
588. J. Kershaw.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, May 27th*, 1859.]

May 23rd.

1244. W. Illingworth.
1252. A. R. M. Normandy.

May 24th.

1275. G. Bell and G. Grimes.
1288. W. Needham and J. Kite.

May 25th.

1263. J. Baird.

From Gazette, May 31st.

May 27, 1859.

1310. E. Marsden.
1313. T. W. Willett.

May 28, 1859.

1283. F. L. Scott, T. Belward, and J. Findlow.
1292. H. Bessemer.

Journal of the Society of Arts.

FRIDAY, JUNE 10, 1859.

EIGHTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Eighth Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on TUESDAY, the 28th inst. (not Monday, the 27th inst., as announced in the last number of the *Journal*), at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference.

ANNUAL DINNER.

The One hundred and fifth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on TUESDAY, the 28th inst., (not Monday the 27th instant, as announced in the last number of the *Journal*), at half-past six for seven o'clock precisely. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Monday, the 13th instant. The Right Hon. Lord Napier will preside.

The day fixed for the dinner has been unavoidably altered, owing to a mistake made by the Manager of the Refreshment Department at St. James's Hall.

UNIFORM MUSICAL PITCH.

The Council of the Society of Arts having had brought under their consideration the question of the alteration of the musical pitch by the French Government, and how far such alteration was likely to affect musical performances in England, the Chairman of Council consulted some of the leading musical authorities, and it appearing to be the nearly general wish that a discussion on the subject should take place, the Council invited the following gentlemen to a meeting at the Society's house last Friday, the 3rd inst. The Asterisks indicate those who were present.

Messrs. Addison and Co.
Mr. Anderson.
*Dr. Arnott, F.R.S.
Mr. T. Aston.
Signor Belletti.
*Mr. Jules Benedict.
Prof. Sterndale Bennett.
Messrs. Bishop.
*Mr. H. Blagrove.
*Mr. Bowley.
Mr. W. Broadwood.
*Messrs. Broadwood & Sons.
Sir Benjamin Brodie, Bart., Pres., R.S.
Mr. Brownsmith.
Dr. Zachariah Buck.
*M. Bruzaud, (Messrs. Erards.)
Mr. J. C. Burgoyne.
*Earl Cawdor, F.R.S.
*Rev. W. Cazalet.
Messrs. Chappell and Co.
Mr. J. B. Chatterton.
*Mr. H. F. Chorley.
The Rt. Hon. Sir George Clerk, Bart.
*Rev.. T. A. Cock.
*Messrs. Collard & Collard
Mr. W. Collard.
*Mr. George Cooper.
Mr. Costa.
*Rev. J. E. Cox.
Mr. W. Cusin.
Mr. James Davison.
Mr. Distin.
Miss Dolby.
Prof. Donaldson.
*Rev. G. T. Driffield.
*Mr. H. Sutherland Edwards.
*Mr. John Ella.
Dr. Elvey.
*Lord Gerald Fitzgerald.
Mr. Garcia.
*Mr. Godfrey.
Prof. Goodeve.
*Mr. Otto Goldschmidt.
*Madame Goldschmidt.
Mr. J. Goss.
*Messrs. Gray and Davison.
*Mr. Henry Griesbach.
Mr. C. L. Gruneisen.
Mr. Halle.
Sir John E. Harington, Bart.
Mr. Harper.
The Rev. F. Helmore, M.A.
The Dean of Hereford.
Sir J. Herschell, Bart.
*Messrs. W. Hill & Son.
*Mr. Hogarth.
*Mr. Edward Hopkins.
*Mr. Edward Holmes.
Earl Howe.
Mr. J. Howell.
Mr. T. P. Hudson.
*Mr. John Hullah.
Messrs. Kirkman & Son.
*Mr. John Köhler.
Mr. Lazarus.
Mr. Henry Leslie.
Mr. H. J. Lincoln.
Mr. Charles Lockey.
Mr. Charles Lucas.
*Professor H. Lunn.
Mr. H. Maudslay.
*Messrs. Metzler and Co.
Mr. Alfred Mellon.
Prof. De Morgan, F.R.S.
*Mr. J. Muir.
*Mr. A. Nicholson.
The Duke of Northumberland, Pres. R. Inst.
The Rev. Sir F. Gore Ouseley, Bart.
Mr. John Parry.
Mr. Henry Phillips.
*Mr. William Pole.
Mr. Cipriani Potter.
Mr. and Mrs. Sims Reeves.
Rev. Dr. Rowden.
*Mr. Lindsay Sloper.
*Sir George Smart.
Mr. Henry Smart.
Prof. Edward Taylor.
Mr. J. Turle.
*Mr. J. R. Tutton.
Mr. Simon Waley.
Mr. John Weippert.
*The Earl of Westmoreland.
Prof. Wheatstone, F.R.S.
Messrs. W. Wheatstone and Co.
*Messrs. Wornum & Sons.
Mr. Waddell.
*Messrs. Walker and Co.
Mr. and Mrs. Weiss.
The Rev. Dr. Whewell, F.R.S.
Mr. Williams.
Professor Willis, F.R.S.
Mr. Henry Willis.
Dr. Wylde.

The following Members of Council were present:—

Mr. C. Wentworth Dilke, Chairman.
Mr. Harry Chester.
Mr. J. G. Frith.
Mr. Joseph Glynn, F.R.S.
Mr. W. Hawes.
Mr. F. R. Sandford.
Mr. Thomas Sopwith, F.R.S.
Mr. T. Twining, Jun.

The meeting took place at 4 o'clock, the Rev. Dr. Whewell, F.R.S., Master of Trinity College, Cambridge, in the Chair.

The Chairman said he had been requested by the Council of the Society of Arts to preside over this meeting, which had been called for the purpose of considering the question of a uniform musical pitch. He scarcely knew why he had been selected to fill that position, but he was willing to do all in his power to further the object in view. He could hardly be said to be in any way connected with musical literature, though the author of a well known work, called "Smith's Harmonics," in which there were some curious calculations upon this subject, had formerly occupied the post which he (the Chairman) then held as Master of Trinity College. He believed that this writer was the first person who determined the pitch by ascertaining the number of vibrations in a second which gave particular notes. This was done in the pipes of the organ at Trinity, and might be said to be the fundamental determination of the pitch in England, so far as mathematical definition was concerned. The subject had recently been more prominently brought before the musical world, in the Report issued by the Commission appointed by the French Government to investigate this question, with the view to the establishment of a uniform pitch to be adopted in that country. In that report, an historical view of the question had been taken, and the number of vibrations of various notes at different periods during the last century and a half had been stated. The question with the Commission was from which of those various numbers the selection was to be made. He had no wish to detain the meeting by remarks of his own upon this subject, as there were many present who had studied it more completely than he had, and who possessed technical knowledge derived from practice, which was not possessed by himself; but he would take the liberty of offering one or two suggestions, with a view of giving some direction to the discussion. The first question to be determined was, whether it was desirable that a uniform musical pitch should prevail; and, secondly, whether it was possible to establish such a uniform pitch in this country. The latter question came before them very naturally, inasmuch as the establishment of a uniform pitch was to be enforced by stringent legal means in France, a course which could not be imitated in this country. The legislative provision upon the matter was that musical instruments not conforming to this regulation, were not to be admitted to any Exhibition of Industry in France. It amounted, in fact, to a prohibition and repression of instruments which were not of the pitch determined upon; and the man who gave false measure in music, was to be dealt with in the same manner as a fraudulent purveyor of meat, or a dishonest vendor of cloth. Of course, it could not be expected that our musical friends in this country were to be subjected to penalties such as those, or that a uniform pitch could be enforced here by any such means. Therefore, they had to consider what means short of these could be used, and whether any influence beyond a general understanding amongst those engaged in music could be brought to bear. These were points upon which those present were well qualified to give opinions, which, he was sure, would be listened to with interest and deference.

Mr. C. Wentworth Dilke, Chairman of Council, then read the following letters which had been received from gentlemen unable to attend:—

Sir,—I regret much that I shall be prevented attending the meeting on Friday next. I perfectly concur in the necessity of establishing a uniform Diapason; the high pitch which is being continually raised is most absurd, and detrimental to the voice, wind instruments stringed and keyed instruments. There can be no difficulty in deciding on a given note mathematically for the Diapason. I am, &c.,

CIPRIANI POTTER.

39, Inverness-terrace, Bayswater, W.,
May 30, 1859.

Sir,—Being unfortunately prevented from attending at the invitation of the Council, I write to express my regret, and at the same time to state, that, as regards ourselves, any alteration in the pitch would not be attended with the slightest inconvenience, and I take the opportunity of expressing our entire concurrence in any moveent by which one uniform pitch could be established.

I am, &c.,
for Self and Partners, (Messrs. Erards),
GEORGE BRUZAUD.

May 30, 1859.

Sir,—I greatly regret my inability to be present at your meeting on Friday. No one can take a more lively interest in the subject-matter to be brought under consideration of the Society of Arts than myself, but unhappily for me I am still suffering from a very severe accident, which makes travelling so great a distance out my power.

Permit me to suggest in the meantime, with great humility, a very simple standard of pitch.

Let a column of air, say an organ pipe of 32 feet long, be put into vibration or undulation, it will be found to give 32 vibrations or undulations at each oscillation of the pendulum. The length in the latitude of London being 39·1393 inches, allowance could easily be made for the slight variation of length in the lower or higher latitudes.

If 32 feet in length = to 32 vibrations, then as the vibrations are inversely as the lengths: a 16 foot pipe = 64 — 8 ft. = 128 — the pitch of the lowest string of a violoncello; computing the vibrations, or undulations, as course and recourse, the pitch adopted in Paris by Rheica in his treatise on harmony.

Will you say to your Committee, with my best compliments, that it would afford me very great pleasure indeed to receive a visit from them at Marchfield House. It would enable me to show them the apparatus used by me for verifying the simple principle to which I have alluded. I am, &c.,

JOHN DONALDSON.

Coltness House, 1st June, 1859.

Dear Sir,—I regret that my engagements in the provinces deprive me of the opportunity of personally attending at the meeting on Friday next; but I have great pleasure in putting my humble views upon paper. There is no doubt that the Musical pitch has been much elevated during the last quarter of a century, and that some disadvantages result therefrom; but it may be questioned whether greater disadvantages would not now be caused by a resumption of the former pitch, or any depression of it. Many of the wind instruments now in use would be injured, and the Artists put to the expense of new ones. The principal organs in Birmingham, Liverpool, Bradford, and other large towns, would have to be altered at great expense.

All purely orchestral performances would also lose much of their brilliancy in the lowering of the stringed instruments. Many other disadvantages occur to me, and will doubtless be brought to your notice. On the other hand, I am not aware that the proposed alteration would benefit any persons except the singers and the wind instrument makers. But considering that Music is the universal language of Europe, it is desirable to establish a uniform pitch between England and the continent, and I would, therefore, recommend that the pitch now in use at the Royal Italian Opera, Covent Garden, under the direction of M. Costa, Esq., should be established as the definite limit to prevent further elevation. But it must be borne in mind that even this pitch cannot be maintained as an absolute rule throughout an entire evening's performance; the warmth of the temperature and the breath of the performers would have the effect of sharpening the wind instruments and necessarily drawing the rest of the orchestra with them.

Regretting that I have not time to say more on the subject, I am, &c.,

ALFRED MELLON.

Waterloo Hotel, Liverpool, June 1st, 1859.

Sir,—I take the liberty of enclosing a series of figures illustrative of the ratios of vibrations of musical intervals, which I wish to submit to the Council of the Society of Arts.

The plan of representing the length of vibrations by two waved lines intersecting each other was adopted after a trial of several others. It has the advantage of representing the comparative numbers, lengths, and points of coincidental vibrations, of a number of combined sounds, and I think renders the subject easy of comprehension generally. I found the diagrams and power of the eye of great assistance to me in appreciating the comparative numbers and points of coincidental vibration, and possibly they may be of use to others. I think that all professional musical students should be acquainted with the natural laws and phenomena of sound.

At page 29 in the paper that accompanies the figures, the fact of there being no uniform musical pitch is noticed, and a reason given why a certain pitch should be generally adopted, and I trust that this point will be decided at the meeting on Friday next.

With many apologies for the trouble I am giving,

I am, &c.,

J. HENRY GRIESBACH.

19, Carlton-road, Maida Vale W., June 1st.

Sir,—I am sorry that I cannot attend the meeting of the Society of Arts on Friday, for the discussion of the subject of a national standard of musical pitch. I hope, however, that you will have the kindness to inform the meeting, by any means that may be at hand, of my very cordial sympathy in the object proposed.

It appears to me that two courses are open—1st. To adopt the French standard. 2nd. To adopt one slightly differing from it, but more convenient and philosophical, which gives 512 vibrations in a second to the note C. I must confess my leaning to this latter plan. The convenience of such a standard for all purposes of acoustical calculation; its near coincidence with the more arbitrary pitch lately adopted abroad; its well-known suitableness for vocal purposes; its agreement with the pitch which prevailed when the master-pieces of Haydn, Mozart, and Beethoven were produced; all these points seem to me to weigh strongly in its favour, and I feel sure that they must have had weight with Mr. J. Hullah when he adopted this excellent pitch as his standard. I hope he will attend the meeting and press these points.

I am, &c.,

FREDERICK A. GORE OUSELEY.

Tenbury, June 1st, 1859.

Mr. John Parry "regrets that he is not able to be present. Thinks that the object of the meeting is an excellent one, and uniformity of pitch most desirable."

Miss Dolby writes regretting she was not able to attend, and expressing her opinion that a uniform musical pitch would be very desirable.

3, Cheyne-walk, S.W., June 3rd, 1859.

Sir,—I much wish to be present at to-day's meeting of the Society of Arts, when the subject of a uniform pitch, or diapason, is to be considered; but as I believe I shall be unable, I beg to state my opinion that the adoption of such a pitch is most desirable, and that, for the sake of vocalists especially, it ought to be considerably lowered.

I will mention two instances of the inconvenience of having no standard pitch.

A few years ago, when the Royal Society of Musicians used to furnish a band to assist at the Annual Service for the Sons of the Clergy at St. Paul's, it was impossible for some of the instruments to tune down to the pitch of my organ, the consequence being that we were never well in tune together.

So much was this felt that, before one of the anniversary meetings, I received a letter from the secretary (written by order), inquiring if I would have any objection to play all the music a semitone higher. I need not say that I declined to do so, as, in addition to the awkwardness of such an undertaking, the unequal temperament of the tuning would have produced perhaps a worse effect than even the discordancy of pitch first described.

A second occasion was at the funeral of the Great Duke, when much of the effect of some of the wind instruments was lost from the endeavour of the performers to lower their pitch to that of my organ.

Regretting that I am necessitated to be elsewhere, I have the pleasure to subscribe myself,—Yours, &c.

JOHN GOSS.

C. Wentworth Dilke, Esq.

The Chairman inquired whether any gentleman had any motion to submit to the meeting.

The Rev. J. Cox, with a view to introduce the discussion, would propose as a resolution:—

That it is desirable that one uniform musical pitch should prevail.

Sir George Smart seconded the resolution.

Dr. Wylde regarded this question as one, if not of very great importance to the art they professed, at least one of considerable interest to the musical world generally. It was to be remarked that composers—the men who studied the science of music and the poetry of sound—cared very little indeed for these details of the art. It mattered not to them whether a vocalist sang at a pitch which might be a little too high or a little too low, so that they got the right effect from their music. At the same time he thought a uniform pitch should be established, and the profession were very much indebted to the Society of Arts for bringing the subject before them, and particularly to the reverend and learned Master who had kindly undertaken to give them his valuable assistance by presiding on this occasion. When they saw one of the greatest intellects of the age engaged upon such a subject, they of smaller minds ought not to hesitate to go into it, and to endeavour to come to some decision. This was a subject which might be discussed both musically and mathematically. He thought, as regarded the musical part of the question, they, the professors of the art, should come to an understanding amongst themselves as to what the pitch should be, and then hand it over to the mathematicians to say what number of vibrations in a second went to form the note decided upon, so that they might be certain that in future the pitch would neither increase nor decrease. He thought one great reason for the lowering of the pitch in France, was to accommodate it to the provinces. In all the provinces of France were to be found Government music schools established for civil and military purposes, and it having been found on inquiry that the pitch used at most of these establishments was lower than those used at Paris, he thought a low pitch had been decided upon in order to suit their convenience. The necessity for this did not exist in England. There were here no provincial music schools to consult. Whatever was done in music was for the most part done in London, and the provinces being dependent on London for their supply of music, a decision come to in London constituted a law for the provinces. He was not for lowering the pitch, because their ears were accustomed to the present high pitch. He did not desire to lower it, although it sometimes strained the voices of the vocalists, as it would spoil the brilliancy of instruments. He did not wish to discuss the mathematical part of the subject; but he only wished to remark that in some passages in the translation of the report of the French commission, in what they termed the "Normal Diapason," the word tone was used erroneously for that of pitch, tone and pitch having widely different meanings. He presumed the A in this report was the A of the tuning fork. Was he to understand that the table of vibrations alluded to this specific A? The learned chairman had mentioned Dr. Smith, formerly master of Trinity College, as the first person who had made calculations on this point. It appeared to him that according to that calculation, the note which they called D—the D below the treble clef, one-fifth lower than the note given in this paper, gave 262 vibrations in a second. The instrument invented by Ramsden, in 1768, gave as the mean result of several experiments, 284 vibrations in a second. In order to form the scale, the rates of vibrations he believed to be—for the second note as 8 to 9; for the third 5 to 4; for the fourth 3 to 4; and for the fifth 2 to 3. How was it then that the Normal Diapason of the

French gave 870 vibrations in a second? It appeared to him that the English and French calculations did not agree by many vibrations.

The Chairman thought they had better not entangle themselves with matters of harmonics.

Dr. Wylde—Taking it as that A, according to our mathematicians it ought only to give about 852 vibrations in a second.

The Chairman—If they got any one note right, all the rest would come right.

Dr. Wylde—True; but if the difference alluded to was nothing to the mathematician, it was something to the musician. He thought it was a question whether the commissioners had not taken the compound fifth for the perfect fifth, the ratio of which was as 1 to 3, but even then the difference of calculation was very great. He did not wish to say more on the subject, only to call attention to it. He hoped that on the musical question they might come to some decision.

Mr. Hullah thought a uniform pitch was highly desirable, and he had been of that opinion for many years. This was not a new subject to him. As far back as the year 1842, which was about the time when he publicly entered upon that particular work on which he had been engaged the greater part of his life, people applied to him to recommend them tuning forks. On inquiry he found that many of those in circulation, all which were supposed to sound the same note, differed from each other; and, as it was certain that all of these could not be right, so it seemed probable that none of them were so. He then set himself to consider whether there was any particular pitch which, on any account whatever, was more desirable than another. Of course a pitch aspiring to universal adoption, must be regulated eventually by what was convenient to the human voice. But there was a further question; whether, having reference to the scientific part of the subject, there was any particular number of vibrations per second which was more convenient than another for simplifying musical calculations. Nothing was more certain than that a very slight difference, such as 508, 510, or 512 was hardly appreciable by the ear, and was practically no inconvenience to any one. He had found the number of 512 vibrations per second for the C, gave the simplest series of numbers representing the other notes, and was very favourable for musical calculations; at the time of which he was speaking, this pitch was a little above some of those then in use, and a little below others, so far as a correct comparison could be made, for that was a difficult matter. He had then with him a pocket full of tuning-forks which he had collected, and no two of them were alike, except those which had been made to his order by a scientific process. It appeared by the evidence that could be collected, that this number of 512 was a fair mean; it was not inconveniently high for voice, nor inconveniently low for instruments. He put himself in communication with Mr. Tomlinson, a gentleman who he found had given a great deal of attention to the subject. Mr. Tomlinson, on being supplied with one of Cagniard de la Tour's instruments for measuring vibrations, the Sirène, satisfied himself that he could regulate this instrument, which every one knew was very difficult to keep at the same pitch, so as to ascertain what was 512 vibrations per second; and he made certain tuning forks, of which he (Mr. Hullah) had seen and tried hundreds, and he had never found the slightest discrepancy in them, except, he might tell them, on that morning, for the first time in his life. He would mention the circumstance, as it might tend to throw light upon a difficult subject which had very much puzzled him—as to whether or not tuning-forks could be depended upon for any length of time. He tried two of those forks with the greatest care again and again that morning. He then placed one of them upon the hot-plate of a kitchen range, and allowed it to remain until it became heated to such an extent that he could only hold it with a glove on, when he found that the pitch was considerably lowered. That was nothing new: but the extraordinary part of the matter was, that the fork had never since recovered its former pitch, and there was still some little discrepancy between it and the fork which had not been heated. To return to the question before them as to the propriety of a uniform pitch, every one who had been in an orchestra must, he thought, agree that such a pitch was highly desirable; nevertheless, he had found that there were different opinions upon the subject. There was a Sig. Staffa, editor of a musical journal published at Naples, who thought there ought to be no fewer than four pitches, having regard to the different qualities of instruments and voices, viz., two for voices, one for the theatre, and another for the Cathedral, and two for instruments. The writer illustrated his theory by the remark that the weight and elasticity of the air so varied in different climates that music could not be executed at the same pitch in Russia as in Africa. How far that was right he could not say. He would, however, give them an instance of the inconvenience arising from the want of uniformity of pitch in the same city. He had, in St. Martin's Hall, an organ which was tuned a little above the pitch of his own tuning-fork, and might be considered as well up to the average concert-pitch of a few years since. He had never, on any recent occasion, been able to use the organ at morning rehearsal, when the temperature was lower than in the evening. The orchestral performers, for the most part, came with their instruments approximately tuned to the present opera-pitch, and they found it impossible to lower them sufficiently to admit of the organ being used. In the evening the pitch of the organ rose with the temperature of the room, though not always sufficiently to remove altogether the discrepancy between it and the wind instruments, which rose in like proportion, the stringed instruments, of course, being obliged to follow them, at a great sacrifice of strings, which were snapping every few moments. The inconvenience to singers resulting from the present high pitch, was sometimes based upon a supposition, of the soundness of which he was not altogether satisfied. He was quite certain that the pitch had risen during the last five-and-twenty years; but it was doubtful whether, in the last 200 years, the pitch had risen at all. Certainly, he did not believe that the pitch in the seventeenth century was at all lower than it was even now. Mr. Hullah then produced several extracts from pieces of music of that period, and asked who were the persons to sing such passages as were there written even at our pitch, for such voices were never heard in the world. They were by no means exceptional passages; as in the anthem, "They that go down to the sea in ships," which was written for a peculiar voice. But in the music he held in his hand there was a first bass part which went down to D, and this, moreover, in a passage where alteration was impossible. In considering this question he thought they would do well to confine themselves principally to the inconvenience arising from the fact that different performers went continually into the same orchestra—it was not so much the case in London as in the country—and found the instruments at different pitches; and with regard to the organ and pianoforte the inconvenience was of daily occurrence. He thought a uniform pitch was so highly to be desired that whatever the pitch might be—whether the highest ever conceived or the lowest, he would vote for it for the sake of uniformity—though he certainly should prefer, and do his best to bring about the adoption of a pitch considerably lower than that at present in use.

Mr. Nicholson had himself been a sufferer from the variation of the pitch throughout the country, and he had made some experiments to show the absolute necessity, if it could be arrived at, of something like uniformity of pitch. At the close of the London season last autumn, they had three musical festivals in the country, and the difference of pitch between the highest and lowest of the organs used was just a semitone; so that the music played in D at Hereford was played in E flat at Leeds. This variation, as affecting the class of instruments upon which he played was very serious. It was impossible to carry about a case of instruments to suit the various pitches, and the only means they had of meeting the difficulty was by using different reeds. The medium reed was that which was in use seven years ago in the orchestra of London, but within the last three years they had got their reeds from Paris, and these had to be made specially to suit the English pitch. This had an injurious effect upon the tones of the instrument, more especially at the extremes of its compass He did not agree with the suggestion made by Mr. Mellon in his letter, that the highest pitch they now had should be the one adopted. He objected to that for many reasons. He thought those who had had experience of the differences of tone in an orchestra, would bear him out that the high pitch they were at present accustomed to was very disagreeable. It made the stringed instruments anything but brilliant; it reduced the size of the strings, and made the tone wiry, and it destroyed the deep volume of sound. There was one other thing he had noticed, and those present who were interested in the scientific part of the subject might be able to make something of it. That was, that in the orchestra mean pitch there was considerable variation in summer and winter; in other words, the pitch of orchestral performances in which he had played during the winter, was perceptibly lower than during the height of summer. If he were to make a suggestion with regard to the advisability of altering the pitch, he should be in favour of a pitch not too low—something near to that of the Exeter-hall organ, and not quite so low as Mr. Hullah's fork; but certainly between the Philharmonic and opera pitch.

Sir George Smart said the question at present before them was whether a musical fixed pitch was desirable, not what that pitch should be. A standard or fixed pitch was no new idea. It was stated that, in the time of Pope Leo X., it was thought convenient to have a bell or large organ pipe, whereon a person used to sound the tone to the choir at the beginning and end of an anthem, and sometimes in the middle of it, to keep the singers to the right pitch. The same practice was pursued by Benedictine monks, in 1673. Therefore, although this was no new subject, he nevertheless thought it a very important one, and one which he hoped would be settled by this movement in favour of a uniform pitch, which, in his humble judgment was highly desirable. He begged to second the resolution proposed by Mr. Cox.

Mr. Benedict thought that the pitch must be regulated by the human voice. The fact was the voice had been too much neglected of late in favour of instrumental effect. He thought the absence of that purity of intonation which had formerly characterised cathedral singers was mainly to be attributed to the excessive height of the pitch, which imparted a kind of factitious brilliancy to the performances, but detracted from the real purity of sound. He therefore entirely agreed with what had fallen from Sir George Smart and the other gentlemen who had spoken, and he hoped the decision would be in favour of lowering the pitch, and not raising it.

Mr. Ella said he happened to be in Paris at the time the report of the Commission was brought up. He believed the subject had been investigated with much perperseverance, and with true love for the art, and that a great deal of time would be saved if, agreeing as he thought all present did, upon the desirability of establishing a uniform pitch, a committee was formed to come to some practical result upon the matter. Whether or not they would decide in favour of the pitch which had been adopted in France he could not say. If they admitted music to be a universal language, it was the more desirable to establish an universal pitch. He had passed 27 years of his life in the orchestras of London; and he thought in dealing with this question, instruments were to be considered rather than voices. Mozart, in his "Zauberflöte," had written a *scena* which very few persons could sing, and there were many similar cases; so that if they took the varying standards of voices, he did not know how they would regulate the standard pitch by them: he thought instruments should establish it. He begged to suggest the propriety of forming a committee to investigate the advisability of adopting the pitch already established in France. He did not say that they ought to adopt that pitch, but he knew that the result had been arrived at after a most diligent investigation of the whole subject, and he thought the question should receive full consideration.

The Chairman gathered from the discussion, as far as it had gone, that the sense of the meeting was, that a uniformity of pitch was desirable, and he thought they need not occupy further time upon that point. With regard to certain difficulties suggested by Mr. Hullah, he thought some of them were to be easily settled. For instance, as to the pitch being higher at the beginning of the last century than it was now—

Mr. Hullah had only said he believed it to have been so.

The Chairman—With regard to the observations of Mr. Nicholson, as to the effect of the difference of temperature in summer and winter upon the pitch, Dr. Smith had alluded to that circumstance in connexion with the pipes of the organ, and he had given the variation in the number of vibrations in the months of November, September, and August, which were found to be in the following ratios:—In November, 254 vibrations; in September, 262 vibrations; and in August, 268 vibrations. As he had already said, he collected that the sense of the meeting was in favour of a uniform pitch. He would now put the resolution which had been proposed to that effect.

The resolution was unanimously passed.

The Chairman said the question which followed upon the preceding one was, what the musical pitch should be. Mr. Hullah having made a decided attempt in that direction, it would be interesting to hear from that gentleman what he had to say in favour of his plan.

Mr. Ella would propose the appointment of a Committee to investigate the pitch which the French commission had established. They had been engaged two years in investigating and discussing the subject, and it was only reasonable to suppose that a vast amount of valuable information had been collected, from some of which it was probable points of value might be gained. It was to be borne in mind, that many of their best orchestral players were Frenchmen. The first oboe at the Italian Opera was a Frenchman, and they always tuned from that instrument.

The Chairman would say that he had never found any good to result from the formation of Committees prematurely before they knew distinctly what they had to determine. He thought they should first hear the arguments for and against the adoption of various pitches.

Mr. Nicholson remarked that the instruments imported from Paris for the use of orchestras in England were in a sharper key than those used in France. Oboes, bassoons, &c., were always made sharper for the English orchestras. An oboe had been lately imported from France which was much flatter than those used in our own orchestras, and it was necessary to have it cut to bring it to the necessary pitch. All the instruments, however, they had from Paris, were generally made with a view to the English pitch.

Mr. Otto Goldschmidt believed that it was agreed on all hands that a uniform pitch was desirable. He ventured to say that the Commission which had sat in Paris was one of the greatest authority; and it was evident from the report which had been put into his hands that day, that they had taken great pains, which might be saved to any future committee that might be appointed. France, whether justly or not, had been considered as the leading power in matters of art, at least so far as the Continent was concerned. According to the information that had been received, it was highly probable that the French pitch as now established would be introduced into all Germany. That perhaps was of no consequence to England; still it tended to prove that it would ultimately become more or less the universal pitch. A friend of his at Munich had written to him to say that he would exert himself to the utmost to get the pitch reduced there, if it were not carried too low. The pitch at Dresden, where they had the finest stringed instruments in the world, within a very few vibrations agreed with the new pitch of Paris, and the rest of Germany was more or less used to a pitch very closely assimilating to that established in France. Of Italy he could not speak, but if this pitch were adopted over the rest of the Continent, it could hardly be supposed that Italy would stand aloof in the general movement, but would also lower her pitch; and if it were lowered, was it not the most natural thing to suppose that they would adopt the French pitch? There ought to be universality in this matter. Music itself was a universal language, and he hoped in this respect it would soon be more harmonious than it was at present. Grand as England was in her musical exertions, he could not conceive that, without any grave reason for it, she would persist in having a pitch exclusively her own. He would say a word with respect to the voice. He did not agree with Mr. Ella that the voice was not to be considered in the settlement of this question. He thought the voice stood paramount. It was clear to every one that the voice could not be altered; and if they looked to the *chefs-d'œuvre* of olden times—he referred to the works of Gluck, Mozart, and Beethoven—there was much music which could not be sung at the present pitch. He hoped this question would be satisfactorily decided.

The Chairman said, without laying claim to any great knowledge of music, he would observe—having read the papers upon the subject which had been put into his hands—that every one must see that there was a perpetual acknowledgment that it was for the interest of the voice to resist that tendency to raise the pitch which had prevailed for a long time. With regard to the propriety of taking the French standard, it must be allowed that being established by so powerful a body of musical influence as was united in producing this report, and so well received as it had been, there was strong reason for their accepting it; and as one who had been engaged in scientific operations of other kinds, he would just give them one word of warning with reference to what took place in another society, with regard to the French metre when that was first established. Some time after this took place, an attempt was made to establish the English standard of measure by the oscillations of the pendulum, and the individual who stood high in the scientific world to whom the experiments were naturally referred, conceived that he had obtained results different from the French, and that therefore their calculations must have been erroneous, when the answer was—"By all means let us have something different from the French." He would merely remark that he thought that was not a wise spirit to act in; and he recommended them to approach the consideration of this question with a disposition rather to adopt, if possible, that which had already obtained a considerable amount of approval, than with a desire to establish anything better, regardless of the merits of the other system.

Mr. Tutton had been connected for twenty-five years with the band of the Horse Guards, during which period the pitch had been getting sharper and sharper. He had with him a little tuning-fork, which represented the pitch established in Belgium, and this was half a tone flatter than the pitch they were at now.

Madame Goldschmidt was of opinion that if the present pitch were adhered to all the voices would be more or less spoiled, and that was one of the reasons why we had so few really good singers. For her own part there was a considerable amount of music that she could not think of singing at the present pitch; and music which she sang with the greatest ease about 12 years ago, when the pitch was lower, she would not now attempt. If the raising of the pitch went on as it had hitherto done, the human voice would lose its beauty and strength; and she did not consider it was proper to tax the voice to that extent. In her opinion the standard of the pitch ought to be regulated by the human voice.

Mr. Goldschmidt did not suggest that they should adopt the French pitch merely because it was French, but chiefly because it was the pitch of the Philharmonic Society and of Broadwood 30 years ago. As it was adopted by France, why should we not also adopt it, especially as it was the good old pitch of olden times?

Mr. Henry Blagrove was decidedly in favour of lowering the pitch. It was certainly questionable whether it would tend to improve his own instrument to lower it, though competent judges of stringed instruments had expressed an opinion that the violin, and its brethren of larger growth, suffered from the present high pitch. He might mention Herr Molique, a good authority on that subject, who considered it was ruining the violin to keep up the pitch to its present height. As regarded the effect of lowering it a little, he thought they would soon get used to it. He considered it would be of the greatest value to have a uniform pitch, and if it were lower than the present one, there would be a strong feeling in favour of it on the part of the organists of cathedrals. Almost all the old organs were very much below the present pitch, very nearly approaching the pitch which was now adopted in France. If they kept up the pitch as high as it now was, it was impossible that these organs could be used in orchestral performances. Mr. Blagrove corroborated Mr. Hullah's statement with regard to the influence of temperature on the pitch of the organ, which caused inconvenience at the morning rehearsals. He believed they would do no practical good until they adopted the French pitch as it now stood. If they recognised the desirability of establishing a uniform pitch, his advice was not to go against their professional brethren abroad. Let them rather go with them if they could. It was true that we owed a great deal to Germany. The finest music known was composed by Germans, and what that nation was likely to do must be taken into consideration; but for his own part he would say that if he were sure the Germans would adopt the French pitch he would have no hesitation in accepting it.

The Chairman was sure the concluding advice of the last speaker would receive due attention. He was afraid that no body of musicians could prevent the pipes of an organ from becoming sharper, or the strings of instruments from getting flatter through the additional heat of the atmosphere in a room; the strings would expand by the influence of heat.

Sir George Smart said Mr. Goldschmidt had alluded to the pitch 30 years ago. He (Sir George Smart) was much concerned in the adoption of that pitch. At that time he found there was a great difference of opinion upon the subject, and he was now delighted to hear Mr. Blagrove pronounce in favour of a lower pitch, for at that time the players of stringed instruments especially were almost universally for raising it. Three of the greatest musicians of the time, viz, Mrs. Billington, Mr. Braham, and Mr. Griesbach assembled at his house, and they determined upon a pitch, the lady acting on the part of the female vocalists, Mr. Braham on that of the male voices, and Mr. Griesbach for the instruments. When those individuals had determined the pitch, he requested Mr. Broadwood to make a fork to that pitch. That fork was sent to Paris during the sitting of the Commission, and it was that which was described in the report as the No. 1 pitch. He granted it was a little flat, but it was purposely so, because, as the Chairman had said, nothing would prevent the rising of the pitch of the pipes of an organ when exposed to a heated atmosphere. It might be difficult in that numerous assembly to fix upon the pitch to be adopted, and if they then came to an agreement upon the subject it could hardly be expected to be satisfactory. He agreed with the remark that had been made, that in the event of a Committee being appointed, it would be well for them to take into consideration what had been said in favour of the French pitch. Doubtless it would be adopted by Germany. He did not say that the French pitch was exactly what it ought to be, but he thought it was very near what he imagined a Committee would decide upon.

The Rev. G. T. Driffield, as a musical amateur, would express a hope that the decision of this meeting would result in the lowering of the pitch which was now prevalent in London. He would urge it with reference to the requirements of the orchestra as well as to the requirements of the human voice, and he spoke the feelings of a large portion of amateurs in the kingdom. He was very much interested in the cause of the human voice, which had undoubtedly suffered by the rise which had been going on in the pitch, and this was more conspicuous in the performance of the chorus parts of the old masters. He especially alluded to what was dear to them all—the works of the immortal Handel. The chorus parts left by that great master had never been heard with all their mellow effects since the pitch was raised to its present scale. Mr. Hullah had expressed a doubt whether the pitch had risen at all during the last 150 or 200 years. He (Mr. Driffield) could not go back to evidence of that remote period, but he could bring forward proofs that during the last 100 years the pitch had risen very considerably. About six years ago he became the purchaser of Handel's own tuning fork, and he had that instrument in his hand. That was evidence of what the pitch was in this country in 1759. It was an A fork. Mr. Driffield also produced another fork, mentioned in the catalogue as being of the same date as that of Handel. The tone was identical, but was an octave lower.

The Chairman thought the point to which the discussion converged was, that it was desirable that a committee should be appointed to report upon the pitch which they recommended to be adopted in England.

Mr. Hullah would be glad to hear from Mr. Walker what would be about the expense, in round numbers, of lowering the pitch of an organ worth £2,000, a quarter of a tone.

Mr. Walker, at a rough guess, should say perhaps £50.

Mr. Davison did not agree with that estimate, for he was convinced that it was very far below the mark. If the pitch were lowered at all in organs, it would be better to lower it half a note, which was the difference between the pitch of the opera orchestra and the proposed French pitch.

Mr. Hullah said this was not strictly so, though it was so within about ten vibrations.

Mr. Davison submitted that the simplest plan would be to transpose the pipes half a note, and put fresh pipes for the lower notes, though in a large organ that would be rather expensive. Of all instruments to be considered in the adoption of a uniform pitch, he thought the organ should especially be taken into account.

Mr. Bowley thought the difficulty in dealing with this question would be to unite a sufficient amount of influence in the musical world generally, so as to lead to the adoption of the views which they decided to be best. Fortunately for us we did not live under the same *régime* as our neighbours across the Channel. We must take a more moderate course. When the organ was placed in Exeter Hall, it was a matter of grave consideration to what diapason it should be tuned, so as to adapt it both to the ancient and modern works which would be performed upon it. They had to reconcile the music of Handel with that of Mendelssohn.

Mr. Blagrove thought if they took the three pitches, Handel's, Sir G. Smart's, and Hullah's, there would be very little difference between them—more especially comparing Hullah's and Smart's. He believed that, within very little, they were identical with the Paris pitch.

Mr. Hullah could assure the meeting that he was not bigoted to any pitch in particular, but he would be delighted to vote for any one upon which they could all agree. The difference between the pitch which had been designated as his and the French pitch, was simply 10 vibrations per second. The French pitch was 522 vibrations per second; his was 512. Practically the difference was hardly appreciable by the ear. He thought if it were an open question to decide between the two pitches, they were so near that it would be wise to decide in favour of the lower pitch, for all the evidence went to show that not only had the pitch a tendency to rise from day to day, but even in the course of an evening, and if they were to reach that pitch which was considered desirable, and to which Madame Goldschmidt had alluded as the one given by nature, the pitch would be lower, and not higher than the present one. He would put on record a remarkable expression which was used some time since by Sir George Smart, in reference to this subject. He said "It is not the Philosopher who has settled the pitch; God Almighty has settled the pitch in making the human voice."

Dr. Arnott said it had been mentioned that great inconvenience had been experienced from the rise of the pitch of the organ in the course of an evening's performance. He thought nothing was easier than to maintain the pitch of the organ by means of an apparatus connected with the bellows communicating with the outer air, and so keeping up a blast of cold air through the pipes, thus preventing their expansion by heat.

Mr. Walker remarked that the cold air must be blown upon the exterior of the pipes as well as upon the interior. Moreover the front pipes of an organ were generally more affected by the heat than the interior pipes.

The Chairman asked whether he was to consider that they had arrived at this point—viz., that it was desirable to appoint a committee to report what pitch they recommended to be adopted. The opinions advanced would find a proper field for discussion in that committee, as well as some other points as yet untouched.

Mr. Tutton remarked that there appeared to be no representative of the important class of wind instruments. If they altered the pitch, they altered the whole construction of wind instruments, as the present wooden instruments could not possibly be adapted to the new pitch, although the brass ones might be. The present clarionets and bassoons were tuned by drawing out the joints, to make them flatter; but if this was done, the ventages should be enlarged, which could not be done upon the existing instruments.

Mr. Harry Chester, as one of the Council, had no desire to interfere in the musical question which now engaged their attention, but he would put it to the meeting whether the recommendations of a Committee, necessarily much smaller than the present assembly, would come with greater authority than a resolution passed by the meeting itself. If they were of opinion that the French pitch was desirable, he would suggest whether they ought not to affirm that by a resolution, rather than defer it to a Committee, whose decision, perhaps not being unanimous, would not come with so much weight as a resolution of this numerous meeting.

Mr. Hullah would like, before the French pitch was adopted, that some person, more conversant with musical calculation than he was, should state what objections—if any—there were to it on that score, because, if not, the difference between that pitch and his was so small, that it might be desirable to adopt the French pitch for the sake of uniformity. He should like to hear the opinion of the Chairman upon this subject before they committed themselves to so important a step.

The Chairman said it might be difficult to find even a small committee in which there would be sufficient unanimity to carry the weight with it which such a decision would require; but, on the other hand, he thought the present meeting was not sufficiently numerous—excluding amateurs like himself—to carry such weight as was requisite for the acceptance of its decision by the musical world at large, especially as it was not understood that the decision of the pitch was to be proposed to the present meeting. With regard to Mr. Hullah's remarks, he would say that every mathematician, at first sight, might have a strong bias in favour of what Mr. Hullah called his standard of 512. Chladni had founded his system upon that number, and no mathematician who expressed the relation of musical notes in numbers could fail to be struck with the advantage for such purposes of that scale, which gave to the middle C 512 vibrations per second. That did not give A a whole number, but it gave a great amount of whole numbers, and in many ways was convenient. Therefore there must naturally be a strong bias in favour of that standard. On the other hand the numerical advantages of the standard were not important. Where the note was determined, they knew what it was by the number of vibrations, whether counted in fractions or decimals, and by that means they could recover the note at any time. Therefore he thought the conveniences and inconveniences were of another kind, and must be considered by practical musicians. The difficulty urged by one speaker that a change of pitch would involve the destruction of a great body of existing instruments was one which must not be overlooked, though some of them no doubt might be modified. The alteration of organs to the new pitch would also be a matter of considerable expense. These were difficulties of far more importance than any want of symmetry in numerical calculations. Still if the French system were adopted over a great part of Europe, so far as there was any perceptible difference between that and 512, musicians would gain more by adopting it than the mathematicians would lose.

Mr. Willis said that when he tuned the organ in Exeter Cathedral, he found the pitch to be a semi-tone below Mr. Hullah's fork, and in accordance with that given by Handel's fork. That organ was built in 1669. He (Mr. Willis) had built several organs, and he believed none of them were above Mr. Hullah's fork. Those at Exeter-hall, and at some of the music halls of London, were above it, but as a general rule he believed the organs in the country would be found to be below the standard which Mr. Hullah had given.

Some conversation then took place on questions of detail, when

The Chairman said it was impossible to settle those minute points here, and he hoped the meeting would arrive at some practical result. He agreed with Mr. Chester that the decision of a Committee might not have the weight of a resolution passed by this general meeting; but the Committee would draw up a report to be submitted to a future general meeting called for that purpose. He thought, under all the circumstances, the appointment of a Committee was the proper course for them to take.

The resolution was then read, and carried unanimously.

"That a Sub-Committee be formed to consider and report what pitch should be adopted."

The following resolution was then proposed and seconded:—

"That the following gentlemen be requested to serve on the before mentioned Committee, and that the Council of the Society of Arts have power to add to or alter such Committee, as may appear to them expedient:—

Dr. Arnott, F.R.S.
Mr. Jules Benedict.
Professor Sterndale Bennett.
Mr. H. Blagrove.
Mr. Bowley.
Mr. W. Broadwood.
M. Bruzaud (Messrs. Erard)
Mr. Collard.
Mr. Costa.
Rev. B. Morgan Cowie.
Professor Donaldson (Edinburgh).
Rev. G. T. Driffield.
Dr. Elvey.
Mr. Godfrey.
Mr. Otto Goldschmidt.
Professor Goodeve.
Mr. F. Davison.
Mr. Henry Griesbach.
Mr. J. Goss.
Mr. Halle.
Mr. Harper.
Mr. W. Hill.
Mr. Edward Hopkins.
Mr. Charles Horsley.
Mr. John Hullah.
Mr. Hy. Leslie.
Professor Lunn.
Mr. Alfred Mellon.
Professor De Morgan, F.R.S.
Mr. A. Nicholson.
The Rev. Sir F. Gore Ouseley, Bart.
Rev. Dr. Rowden.
Mr. W. Pole.
Mr. Cipriani Potter.
Sir George Smart.
Mr. J. Turle.
Mr. Tutton.
Mr. Waddell.
Mr. Walker.
The Earl of Westmoreland.
Prof. Wheatstone, F.R.S.
The Rev. Dr. Whewell, F.R.S.
Professor Willis, F.R.S.
Mr. Henry Willis.
Dr. Wylde.

Members of Council.

Mr. C. Wentworth Dilke (Chairman).
Mr. Harry Chester.
Mr. W. Hawes.
Mr. F. R. Sandford.
Mr. Thos. Sopwith, F.R.S.
Mr. T. Twining, Jun.

Mr. C. Wentworth Dilke proposed a vote of thanks to Dr. Whewell for his kindness in presiding over the meeting, and for the ability with which he had discharged the duties of chairman, which, having been seconded by Mr. Harry Chester, was carried by acclamation, and the proceedings terminated.

EXAMINATIONS, 1859.

PRIZES AND CERTIFICATES AWARDED TO CANDIDATES.*

PRIZES.

Arithmetic ...	1st Prize...	£5	To No.	51—John Palethorp, aged 20, Mechanics' Institution, Glasgow—Clerk
	2nd Prize..	3	,,	439—James Henderson, aged 20, Athenæum, Glasgow—Clerk
Book-keeping	1st Prize...	5	,,	255—Thomas Myers, aged 20, Young Men's Christian Institution, Leeds—Clerk
	2nd Prize..	3	,,	397—Henry Simpson, aged 18, Messrs. Chance's Library and Reading Room, Birmingham—Clerk
Algebra	1st Prize...	5	,,	409—George Hale, aged 18, Athenæum, Bristol
	2nd Prize..	3	,,	288—Hugh Battle, aged 38, Church of England Institution, Leicester—Missionary
Geometry and Mensuration	1st Prize...	5	,,	223—Joseph Benjamin Rundell, aged 25, Pimlico Literary Institution—Clerk
	2nd Prize..	3	,,	267—Alfred Pickard, aged 17, Young Men's Christian Institution, Leeds—Clerk
Trigonometry	1st Prize...	5	,,	409—George Hale, aged 18, Athenæum, Bristol
				No Second Prize Awarded.†

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* The Prizes Awarded to Institutions and Local Boards will be announced in a future number.

† The Candidate standing Second in this Subject did not obtain a First-class Certificate.

Conic Sections	1st Prize...	£5	To No. 409—George Hale, aged 18, Athenæum, Bristol
			No Second Prize Awarded.†
Statics, Dynamics, and Hydrostatics	1st Prize ...	5	,, 409—George Hale, aged 18, Athenæum, Bristol
	2nd Prize ..	3	,, 302—Charles Herbert Ellerby, aged 17, Mechanics' Institution, Manchester—Mechanical Draughtsman
Practical Mechanics	...		*No Prizes Awarded.*‡
Electricity, Magnetism, and Heat ...	1st Prize ...	5	,, 471—Frederick William Rudler, aged 18, Royal Polytechnic Institution Classes—Solicitor's Clerk
	2nd Prize ..	3	,, 489—Joseph James Coleman, aged 20, Mechanics' Institution, Halifax—Chemist and Druggist
Chemistry ...	1st Prize ...	5	,, 375—Charles Josiah Woodward, aged 20, Birmingham and Midland Institute—Chemical Teachers' Assistant
	2nd Prize ..	3	,, 478—Francis Henry Keeble, aged 19, Royal Polytechnic Institution Classes—Cabinet-maker
Animal Physiology	...		*No Prizes Awarded.*‡
Botany	...		*No Prizes Awarded.*‡
Political Economy.........	1st Prize ...	5	,, 123—William Martin Wood, aged 30, People's College, Sheffield—Grocer
			No Second Prize Awarded.†
Geography ...	1st Prize ...	5	,, 487—William Thomas Dewhirst, aged 17, Mechanics' Institution, Halifax—Telegraph Clerk
	2nd Prize ..	3	,, 347—Joseph Harrison, aged 17, Mechanics' Institution, Bradford—Woolsorter
English History	1st Prize...	5	,, 490—Joseph Fox, aged 22, Mechanics' Institution, Halifax—Timber Merchant
	2nd Prize ..	3	,, 89—Augustus Meymott Wiele, aged 30, Pembroke Dock Mechanics' Institute—Clerk
English Literature	1st Prize ...	5	,, 411—Henri Sundius Vully De Candole, aged 17, Athenæum, Bristol
	2nd Prize ..	3	,, 413—Duncan Crookes Tovey, aged 17, Athenæum, Bristol.
Latin and Roman History	1st Prize ...	5	,, 413—Duncan Crookes Tovey, aged 17, Athenæum, Bristol.
	2nd Prize ..	3	,, 431—William Aitchison Runciman, aged 19, Athenæum, Glasgow—Clerk.
French	1st Prize ...	5	,, 32—William Cree Crauford, aged 19, Mechanics' Institution, Glasgow—Clerk.
	2nd Prize ..	3	,, 530—Henry Legg, aged 22, Crosby Hall Evening Classes.
German	1st Prize ...	5	,, 514—Samuel Lee Cressall, aged 21, Crosby Hall Evening Classes—Clerk.
			No Second Prize Awarded.†
Music	...		*No Prizes Awarded.*‡

† The Candidate standing Second in this Subject did not obtain a First-class Certificate.
‡ No Candidate obtained a First-class Certificate in this Subject.

CERTIFICATES.

The following is an Alphabetical List of the Candidates who have obtained Certificates :—

(1st) after a subject signifies a First-class Certificate (Excellence).
(2nd) ,, ,, Second-class ,, (Proficiency).
(3rd) ,, ,, Third-class ,, (Competency).

(The occupations stated are either present or proposed.)

No.
492—Abbot, James, aged 21, Liverpool Inst., Engineer—Geometry and Mensuration (3rd)
301—Abram, Robert, aged 17, Manchester M. I., Japanner—Arithmetic (3rd)
24—Adamson, John, aged 21, Glasgow M.I., Cashier—French (3rd)
25—Anderson, James, aged 21, Glasgow M.I., Clerk—Algebra (3rd); Geometry and Mensuration (3rd)
112—Anderson, James, aged 37, People's College, Sheffield, Bootmaker—English History (3rd)
357—Anderson, John Broadbent, aged 17, Bradford M.I., Woolsorter—Music (3rd)
188—Anderson, Thomas, aged 19, Aberdeen M.I., Grocer—Arithmetic (3rd)
334—Andrews, Dormer, aged 19, Portsea Watt Inst., Sailmaker's Apprentice—Arithmetic (1st); Algebra (3rd)
281—Anty, George, aged 39, Leeds Young Men's Christian I., Cashier—Book-keeping (3rd)
107—Anty, Samuel Bates, aged 33, People's College, Sheffield, Law Clerk—Arithmetic (3rd); Bookkeeping (3rd)
248—Arthur, William, aged 22, Glasgow M.I., Surveyor and Engineer—Geometry and Mensuration (2nd); Chemistry (2nd)
320—Ashworth, Arthur, aged 19, Manchester M.I., Engineer—Arithmetic (3rd); Algebra (3rd); Geometry and Mensuration (2nd)
210—Atkinson, Henry Dresser, aged 17, Selby M.I., Usher—Algebra (3rd); English Literature (3rd)
73—Aumonier, Frederic, aged 21, London M.I., Salesman at Paper-hanging Warehouse—French (2nd)
312—Ayrton, William, aged 21, Manchester M.I., Clerk—Arithmetic (2nd)
8—Baker, Thomas, aged 17, Blandford Literary I., Chemist and Druggist—French (2nd)
458—Bannister, William, aged 21, Leeds M.I., Slubber—English History (3rd)

298—Barlow, Thomas Kendall, aged 22, Leicester Church of England I., Attorney's Clerk—Arithmetic (2nd) Book-keeping (3rd); Algebra (2nd)
222—Barnish, William Croudson, aged 19, Wigan M.I., Druggist and Grocer—Chemistry (3rd)
26—Barr, George Morrison, aged 22, Glasgow M.I., Land Surveyor—Algebra (3rd); Statics, &c. (2nd)
27—Barr, Thomas Morrison, aged 24, Glasgow M.I., Land Surveyor—Statics, &c. (2nd)
304—Bates, Arthur, aged 21, Manchester M.I., Clerk—French (2nd)
288—Battle, Hugh, aged 38, Leicester Church of England I., Missionary—Algebra (1st) with 2nd Prize; Geometry and Mensuration (1st); Trigonometry (2nd); Conic Sections (2nd)
217—Bedford, Thomas, aged 29, Selby M.I., Teacher—Arithmetic (3rd); Political Economy (3rd)
242—Bell, William, aged 18, People's Reading Rooms, Belfast, Commission Merchant—Political Economy (3rd)
232—Benson, George, aged 17, People's Reading Rooms, Belfast, Clerk—Arithmetic (3rd)
310—Bibby, Maurice, aged 21, Manchester M.I., Clerk—Arithmetic (2nd); Book-keeping (3rd); French (3rd)
196—Bidwell, William Henry, aged 17, Ipswich M.I., Clerk—Arithmetic (3rd); Latin and Roman History (3rd)
308—Birtles, John, aged 22, Manchester M.I., Book-keeper—French (2nd)
102—Blake, Isaac, aged 33, People's College, Sheffield, Clerk and Salesman—English History (2nd); English Literature (2nd)
98—Booth, Frederick, aged 20, People's College, Sheffield, Book-keeper—Book-keeping (3rd)
525—Bound, Edward Charles, aged 17, Crosby Hall Evening Classes, Government Clerk—English Literature (3rd)
534—Brady, James, aged 20, Crosby Hall Evening Classes, Carpenter and Joiner—Arithmetic (2nd); Geometry and Mensuration (3rd)
202—Brammer, John, aged 17, Lockwood M.I., Cloth-dresser—Geography (3rd)
116—Bramwell, John Henry, aged 17, People's College, Sheffield, File-cutter—French (3rd)
376—Branthwaite, Harrison, jun., aged 30, Birmingham and Midland I., Druggist—Chemistry (2nd)
457—Brearley, Robert, aged 25, Leeds M.I., Clerk—Book-keeping (2nd); French (3rd); German (3rd)
476—Bright, William, aged 22, Royal Polytechnic Inst. Classes, Journeyman Brushmaker—Chemistry (3rd)
29—Brodie, William, aged 16, Glasgow M.I., Colour-maker—Chemistry (3rd)
152—Brodie, William, aged 29, Aberdeen M.I., Clerk—Algebra (3rd); Statics, &c. (2nd)
260—Brooke, Henry, aged 18, Leeds Young Men's Christian I., Draper—French (3rd)
498—Brooke, Thomas Willshire, aged 17, Liverpool I., Clerk—Arithmetic (3rd)
480—Brooks, Adam, aged 32, Bury Athenæum, Wheelwright—Arithmetic (3rd)
391—Browett, Alfred, jun., aged 21, Birmingham and Midland I., Manufacturer—English History (2nd)
463—Brown, Joseph Frederick, aged 16, Frome M.I., Military Schoolmaster—Arithmetic (1st)
28—Brown, Robert, aged 17, Glasgow M.I., Clerk—Chemistry (3rd)
243—Browne, David D., aged 23, People's Reading Rooms, Belfast, Teacher—French (3rd)
346—Buckle, Richard, aged 18, Bradford M.I., Grocer—Arithmetic (2nd)
1—Bullock, George, aged 33, Working Men's I., Ashburne, Artist—Animal Physiology (3rd)
372—Bulmer, Richard, aged 18, York Institute, Clerk—Book-keeping (1st)
206—Burgess, Robert, aged 18, Louth M.I., Ironmonger—Statics, &c. (2nd)
380—Butler, James Henry, aged 17, Working Men's College, Birmingham, Presser and Stamper—Arithmetic (1st); Book-keeping (3rd); Algebra (3rd)
422—Cameron, Robert, aged 19, Glasgow Athenæum, Clerk—English Literature (2nd)
355—Chambers, Thomas Hodgson, aged 18, Bradford M.I., Accountant's Clerk—Arithmetic (1st); Book-keeping (3rd)
199—Chapman, Thomas Wood, aged 29, Ipswich M.I., Clerk of Inland Revenue—Arithmetic (1st)
297—Charters, Edward, aged 23, Leicester Church of England I., Warehouseman—Geography (2nd)
128—Cheetham, William, aged 17, Church of England Educational I., Sheffield, Cutler—Algebra (2nd); Geometry and Mensuration (3rd); Trigonometry (3rd)
92—Christie, Charles Augustus, aged 18, Pembroke Dock M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
434—Cleland, William Whyte, aged 20, Glasgow Athenæum, Stationer—Arithmetic (2nd)
538—Clements, George Stubbs, aged 24, Crosby Hall Evening Classes, Bank Clerk—Arithmetic (3rd)
529—Clementson, Alfred Bland, aged 18, Crosby Hall Evening Classes, Clerk—Arithmetic (3rd)
412—Clift, Edward, aged 16, Bristol Athenæum—Geometry and Mensuration (2nd); Trigonometry (3rd)
467—Coates, Walter, aged 24, Royal Polytechnic Inst. Classes, Clerk—German (3rd)
446—Cockroft, Edwin, aged 21, Working Men's College, Halifax, Stover—Arithmetic (2nd)
452—Cockroft, Richard, aged 19, Working Men's College, Halifax, Warehouseman—Bookkeeping (1st)
21—Coleman, Frank William, aged 23, Crosby Hall Evening Classes, Teacher—Algebra (3rd); Trigonometry (2nd)
489—Coleman, Joseph James, aged 20, Halifax M.I., Chemist and Druggist—Electricity, Magnetism, &c. (1st) with 2nd Prize.
293—Collins, Samuel, aged 18, Leicester Church of England I., Hosier—Book-keeping (3rd)
544—Conder, James, aged 19, Hitchin M.I., Land Surveyor—English History (3rd)
170—Cooper, Arthur, aged 28, Aberdeen M.I., Labourer—Statics, &c. (3rd); Electricity, Magnetism &c. (3rd)
384—Cope, William, jun., aged 31, Birmingham and Midland I., File Manufacturer—French (3rd)
548—Cornthwaite, Robert, aged 23, Skipton M.I., Book-keeper—Arithmetic (2nd); Algebra (3rd)
186—Cousin, James, aged 17, Aberdeen M.I., Clerk—Arithmetic (3rd)
115—Colver, William, aged 19, People's College, Sheffield, Hosier—French (3rd)
253—Cowell, Charles, aged 19, Leeds Young Men's Christian I., Compositor—English History (3rd); English Literature (2nd)
246—Cowell, Charles, aged 22, Canterbury Church of England Young Men's L.I., Chemist—Arithmetic (2nd)
299—Cox, Samuel, aged 25, Leicester Church of England I., Engineer's Clerk—Book-keeping (3rd)
181—Craig, John, aged 17, Aberdeen M.I., Student—Statics, &c. (3rd)
32—Crawford, William Cree, aged 19, Glasgow M.I., Clerk—French (1st) with 1st Prize.
31—Cree, William McLaurin, aged 25, Glasgow M.I., Jeweller—French (2nd)
514—Cressall, Samuel Lee, aged 21, Crosby Hall Evening Classes, Clerk—Book-keeping (1st); French (2nd); German (1st) with 1st Prize.
494—Cross, Samuel, aged 17, Liverpool I., Clerk—Arithmetic (3rd)

453—Crossley, William, aged 20, Working Men's College, Halifax, Chemist and Druggist—Chemistry (1st)
311—Cuthbertson, John Guthrie, aged 21, Glasgow M.I., Clerk—French (3rd)
283—Dalby, Edward, aged 16, Leeds Young Men's Christian I., Mechanic—Arithmetic (3rd); Practical Mechanics (3rd)
459—Dawson, William, aged 18, Leeds M.I., Engineer—Arithmetic (3rd); Statics, &c. (3rd); Practical Mechanics (3rd)
286—Dean, Thomas, aged 17, Leeds Young Men's Christian I., Clerk—Book-keeping (3rd)
411—De Candole, Henri Sundius Vully, aged 17, Bristol Athenæum—Algebra (3rd); English History (2nd); Latin and Roman History (2nd); English Literature (1st) with 1st Prize.
367—Dempster, Augustus Edward, aged 16, Warminster Athenæum, Architect—Arithmetic (3rd)
487—Dewhirst, William Thomas, aged 17, Halifax M.I., Telegraph Clerk—Geography (1st) with 1st Prize.
71—Dickie, James, aged 20, London M.I., Clerk—Arithmetic (3rd); French (3rd)
224—Donelly, Thomas, aged 18, Banbury M.I., Attorney's Clerk—Arithmetic (3rd); Book-keeping (3rd)
103—Dresser, Thomas, aged 25, People's College, Sheffield, Post-office Clerk—English History (2nd)
518—Driver, Thomas George, aged 18, Crosby Hall Evening Classes, Oilman—Arithmetic (1st)
523—Drury, Henry George, aged 19, Crosby Hall Evening Classes, Clerk—Arithmetic (2nd)
33—Duncan, Henry, aged 18, Glasgow M.I., Civil Engineer—Arithmetic (2nd); Algebra (3rd); Geometry and Mensuration (2nd)
535—Eachus, George Eades, aged 18, Eastern Counties R. and Stratford L.S., Engineers—Algebra (3rd)
483—Edwards, William Evan, aged 21, London Domestic Mission, Solicitor's Clerk—Arithmetic (2nd)
302—Ellerby, Charles Herbert, aged 17, Manchester M.I., Mechanical Draughtsman—Arithmetic (1st); Algebra (3rd); Statics, &c. (1st) with 2d Prize.
505—Evans, Rowland, aged 16, Liverpool I.—Algebra (3rd); Geometry and Mensuration (2nd); Chemistry (3rd)
408—Evanson, Charles Payne, aged 17, Bristol Athenæum—Algebra (3rd); Latin only (1st); Mensuration (2nd)
36—Fairlie, Colin Buchanan, aged 21, Glasgow M.I., Civil Engineer—Arithmetic (1st); Algebra (2nd); Geometry and Mensuration (2nd)
35—Farm, Andrew, aged 28, Glasgow M.I., Pattern Drawer—French (3rd)
256—Fearnside, Edwin, aged 21, Leeds Young Men's Christian I., Book-keeper—Book-keeping (1st)
156—Forbes, Alexander, aged 25, Aberdeen M.I., Clerk—Arithmetic (3rd)
359—Foster, Alfred, aged 20, Bradford M.I., Waste Dealer—Arithmetic (3rd)
536—Fowler, George Cupit, aged 23, Crosby Hall Evening Classes, Oilman—Arithmetic (2nd)
490—Fox, Joseph, aged 22, Halifax M.I., Timber Merchant—English History (1st) with 1st prize; French (1st)
374—Frankland, William, aged 22, York M.I., Joiner—Arithmetic (2nd)
261—Freeman, Edmond, aged 19, Leeds Young Men's Christian I., Draper—French (3rd)
440—French, George J., aged 21, Glasgow Athenæum, Clerk—French (2nd)
90—Froyne, John Charles, aged 24, Pembroke Dock M.I., Shipwright—Algebra (2nd); Trigonometry (3rd)
481—Furness, John Thomas, aged 19, Bury Athenæum, Hatter—Arithmetic (2nd)
423—Gardner, John R., aged 19, Glasgow Athenæum, Clerk—English Literature, (3rd)
403—Genner, Job, aged 19, Messrs. Chance's Library, Birmingham, Clerk—Book-keeping (3rd)
38—Gibb, Thomas, aged 19, Glasgow M.I., Mining Engineer—Arithmetic (2nd)
247—Gibbs, John, aged 36, Chelmsford L. and M.I., Woolsorter—Botany (2nd)
130—Gill, Wm., aged 27, Ch. of Eng. Educational I., Sheffield, Merchant's Clerk—Latin & Roman History (2nd)
81—Gillespie, Thomas, aged 16, Newcastle Church of England I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
295—Gillespie, Richard William, aged 25, Leicester Church of England I., Solicitor's Clerk—Arithmetic (1st)
37—Glen, James, aged 18, Glasgow M.I., Clerk—Arithmetic (3rd); French (2nd)
289—Godfrey, Isaac, aged 17, Leicester Church of England I., Hosier—Arithmetic (2nd)
537—Goldsmith, John Joseph, aged 20, Crosby Hall Evening Classes, Architect's Assistant—Music (3rd)
504—Gordon, Robert, aged 18, Liverpool I., Millwright—Algebra (3rd); Geometry and Mensuration (2nd)
95—Gouldsmith, Henry, aged 17, Pimlico L.S. and M.I., Clerk in an Estate Agency Office—Arithmetic (1st)
436—Graham, Daniel, aged 21, Glasgow Athenæum, Book-keeper—Book-keeping (3rd)
339—Greenhough, John Gresham, aged 16, Bradford M.I., Merchant's Clerk—Arithmetic (1st); Algebra (3rd)
448—Greenwood, Samuel, aged 19, Working Men's College, Halifax, Card Writer—Arithmetic (3rd)
329—Gresty, Jonathan, aged 22, Manchester M.I., Warehouseman—Book-keeping (3rd)
477—Grimson, Samuel Deane, aged 18, Royal Polytechnic Inst. Classes—Geometry and Mensuration (2nd); French (3rd)
517—Grosvenor, Edward, aged 20, Crosby Hall Evening Classes, Compositor—French (2nd)
216—Gutteridge, Michael, aged 16, Selby M.I., Draper—Arithmetic (3rd)
409—Hale, George, aged 18, Bristol Athenæum—Algebra (1st) with 1st Prize; Trigonometry (1st) with 1st Prize; Conic Sections (1st) with 1st Prize; Statics, &c. (1st) with 1st Prize.
417—Hale, Matthew Henry, aged 25, Bristol Athenæum, Clerk—French (1st)
410—Hale, William Wilkins, aged 23, Bristol Athenæum, Custom's Clerk—French (3rd)
291—Hall, James Barlow, aged 22, Leicester Church of England I., Grocer's Assistant—Book-keeping (3rd)
460—Hamilton, Talbot, aged 18, Manchester M.I., Engineer—Arithmetic (1st); Algebra (3rd); Geometry and Mensuration (3rd); Conic Sections (3rd)
292—Hancock, John Henry, aged 18, Leicester Church of England I., Warehouseman—Arithmetic (2nd)
294—Harley, John Charles, aged 18, Leicester Church of England I., Railway Clerk—Arithmetic (2nd)
150—Harrison, George, aged 22, Wakefield M.I., Assistant Surveyor of Taxes—English History (3rd)
347—Harrison, Joseph, aged 17, Bradford M.I., Woolsorter—Geography (1st) with 2nd Prize; English History (3rd)
175—Harrow, George, aged 16, Aberdeen M.I., Clerk—Book-keeping (3rd)
322—Hart, Henry, aged 21, Manchester M.I., Clerk—Book-keeping (2nd)
273—Hartley, William, aged 17, Leeds Young Men's Christian I., Clerk—Arithmetic (3rd); Book-keeping (3rd); Political Economy (3rd)
111—Hasler, John, aged 26, People's College, Sheffield, Planemaker—French (2nd); Germn (3rd)
333—Hawes, John William, aged 16, Watt I., Portsea, Engineer—Arithmetic (2nd); Algebra (2nd); Geometry and Mensuration (2nd)

208—Hay, James, aged 20, Paisley Artizan's I., Apprentice Engineer—Statics, &c. (3rd)

437—Hay, Thomas Hastie, aged 18, Glasgow Athenæum, Clerk—Book-keeping (3rd)

316—Heathcote, William, aged 20, Manchester M.I., Mechanic—Practical Mechanics (3rd)

454—Hebden, William Carr, aged 19, Working Man's College, Halifax, Chemist and Druggist—Chemistry (2nd)

455—Heigham, Thomas, aged 20, Working Man's College, Halifax, Chemist and Druggist—Chemistry (2nd)

439—Henderson, James, aged 20, Glasgow Athenæum, Clerk—Arithmetic (1st) with 2nd Prize; Algebra (3rd); English Literature (2nd)

474—Henshaw, Thomas Pigot, aged 17, Royal Polytechnic Inst. Classes, Clerk—Chemistry (1st)

274—Hick, Thomas, aged 18, Leeds Young Men's Christian I., Teacher—Arithmetic (1st); Algebra (2nd); Geometry and Mensuration (2nd)

110—Hill, Thomas Vardy, aged 21, People's College, Sheffield, Clerk—Arithmetic (3rd)

472—Hind, Francis Henry Philip, aged 17, Royal Polytechnic Inst. Classes, Barrister's Clerk—Chemistry (2nd)

96—Hiscoke, William John, aged 21, Richmond Young Men's Society, Bookseller—Arithmetic (2nd)

365—Hitchcock, William, aged 23, Stanley Library Athenæum, Lynn, Banker's Clerk—Geography (2nd); English History (2nd)

10—Hodgson, James, aged 17, Blackburn M.I., Plasterer—Arithmetic (2nd); Geometry and Mensuration (3rd)

6—Hood, James Wallace, aged 28, S.E. Railway M.I., Ashford, Engine Fitter—Arithmetic (3rd); Book-keeping (3rd)

84—Horz, Conrad, aged 20, Church of England I., Gentleman's Servant—Book-keeping (3rd)

468—Howard, George, aged 19, Royal Polytechnic Inst. Classes, Clerk—Arithmetic (1st); Book-keeping (3rd); French (3rd)

516—Howard, Thomas Ross, aged 23, Crosby Hall Evening Classes, Custom-house Clerk—French (1st)

521—Hughesdon, Joseph Charles, aged 16, Crosby Hall Evening Classes, Clerk—Latin only (2nd)

100—Hutchinson, William Thomas, aged 29, People's College, Sheffield, Butcher—English History (2nd)

262—Illingworth, George, aged 21, Leeds Young Men's Christian I., Mechanic—Arithmetic (3rd); German (3rd)

526—Israel, Henry Ash, aged 19, Crosby Hall Evening Classes, Carcase Butcher and Commission Salesman—Arithmetic (2nd)

469—Israel, Louis Ash, aged 21, Royal Polytechnic Inst. Classes, Commission Salesman—Chemistry (3rd)

479—Jackson, Edmund, aged 24, Bury Athenæum, Schoolmaster—Arithmetic (3rd)

342—Jackson, James Richard, aged 19, Bradford M.I., Working Engineer—Arithmetic (3rd); Geometry and Mensuration (3rd)

219—Jackson, John, aged 18, Wigan M.I., Dispenser—Chemistry (3rd)

418—Jackson, John, aged 18, Glasgow Athenæum, Clerk—Book-keeping (3rd)

496—Jackson, William Robert, aged 19, Liverpool I., Watchmaker—Arithmetic (3rd)

300—Jacob, Edward Westley, aged 19, Manchester M.I., Engineer—Arithmetic (3rd); Algebra (3rd); Statics, &c. (2nd); Chemistry (2nd)

543—Jeeves, Alfred, aged 23, Hitchin M.I., Solicitor's Clerk—Arithmetic (3rd); Book-keeping (3rd)

343—Jowett, James, aged 16, Bradford M.I., Compositor—English History (3rd)

132—Kay, Samuel, aged 19, Church of England Educational I., Sheffield, Edge-tool Striker—Latin and Roman History (2nd)

478—Keeble, Francis Henry, aged 19, Royal Polytechnic Inst. Classes, Cabinet Maker—Electricity, Magnetism, &c. (3rd); Chemistry (1st) with 2nd Prize

350—Kennedy, James, aged 16, Bradford M.I., Clerk—Geography (2nd)

9—Kent, Edwin Giddings, aged 22, L.I., Blandford, Builder—Geography (3rd); English History (3rd)

390—Kidson, Samuel, aged 30, Birmingham and Midland I., Warehouseman—English History (2nd)

23—King, John, aged 22, Carshalton Mutual Improvement Society, Gardener—Book-keeping (3rd)

456—Knapton, William, aged 31, Leeds M.I., Mason—German (2nd)

491—Laurie, John, aged 17, Liverpool I., Architect—Algebra (3rd); Geometry and Mensuration (3rd); Chemistry (2nd)

432—Lawson, William Ramage, aged 18, Glasgow Athenæum, Junior Clerk—Book-keeping (2nd)

445—Leach, John, aged 18, Working Men's College, Halifax, Clerk—Arithmetic (1st); English Literature (3rd)

129—Leadbeater, Edwin, aged 19, Church of England Educational I., Sheffield, Merchant's Clerk—Algebra (3rd); Trigonometry (3rd)

530—Legg, Henry, aged 22, Crosby Hall Evening Classes—French (1st) with 2nd Prize

99—Lenthall, Carter, aged 32, People's College, Sheffield, Warehouseman—Book-keeping (3rd)

421—Linn, William C., aged 18, Glasgow Athenæum, Draper—English Literature (3rd)

280—Lister, Alfred, aged 16, Leeds Young Men's Christian I., Assistant Teacher—Political Economy (3rd)

105—Lister, John, aged 30, People's College, Sheffield, Butcher—Latin, and Roman History (3rd); English Literature (3rd)

149—Logan, Henry, aged 18, Wakefield M.I., Iron-moulder—Arithmetic (2nd); Geometry and Mensuration (2nd)

404—Lovell, Margaret Lydia, aged 18, Bristol Athenæum—French (3rd)

377—Lucas, William, aged 32, Birmingham and Midland I., Cordwainer—Chemistry (2nd)

85—Lyall, William, aged 25, Newcastle Church of England I., Letter-press Printer—Arithmetic (2nd); Algebra (3rd)

21—Marsh, Clement, aged 19, Manchester M.I., Warehouseman—French (3rd)

257—May, Thomas, aged 30, Leeds Young Men's Christian I., Mechanic—Algebra (2nd); Geometry and Mensuration (3rd)

173—McDonald, James, aged 19, Aberdeen M.I., Land-surveyor—Arithmetic (2nd); Algebra (3rd)

41—McDougall, John, aged 25, Glasgow M.I., Mercantile Clerk—Book-keeping (3rd)

174—McHardy, David, aged 20, Aberdeen M.I., Blacksmith—Geography, (3rd)

42—Macdonald, Archibald Simon Lang, aged 19, Glasgow M.I., Mercantile Clerk—Arithmetic (1st); Chemistry (1st)

45—Macintyre, John Stevenson, aged 20, Glasgow M.I., Civil Engineer and Architect—Arithmetic (2nd); Statics, &c. (2nd)

44—Macintyre, Robert, aged 18, Glasgow M.I., Book-keeper—Arithmetic (3rd); Book-keeping (3rd)

43—McIntyre, Robert, aged 21, Glasgow M.I., Brassfounder—Statics, &c. (3rd); Practical Mechanics (3rd)
176—Mackay, Robert, aged 31, Aberdeen M.I., Clerk—English Literature (3rd)
180—Mackillican, John, aged 26, Aberdeen M.I., Watchmaker—Statics, &c. (3rd)
385—Mackintosh, Charles Simmons, aged 30, Birmingham and Midland I., Reader for the Press—French (2nd)
331—Marcus, John Augustus Henry, aged 18, Watt Institute, Portsea—Pattern-maker—Geometry and Mensuration (3rd)
515—Mears, Henry, aged 23, Crosby Hall Evening Classes, Warehouseman—French (3rd)
76—Medcraft, William Miles, aged 32, Sherwood (Battersea) Mutual Improvement I., Assistant Foreman—Geography (3rd)
353—Metcalfe, David, aged 24, Bradford M.I., Cabinet-maker—Arithmetic (3rd)
171—Middleton, William, aged 26, Aberdeen M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
340—Midgley, John Whitworth, aged 31, Bradford M.I., House Agent—German (3rd)
509—Millard, John, aged 20, Crosby Hall Evening Classes, Optician—English Literature (3rd)
290—Miles, Alfred, aged 18, Leicester Church of England I., Solicitor's Clerk—Arithmetic (1st)
86—Miller, John, aged 22, Newcastle Church of England I., Engineer—Geography (3rd)
524—Miller, Richard, aged 18, Crosby Hall Evening Classes, Engraver—Arithmetic (3rd)
348—Mills, James, Jun., aged 21, Bradford M.I., Warehouseman—Algebra (3rd)
420—Monro, Alexander, aged 18, Glasgow Athenæum, Merchant's Clerk—Book-keeping (2nd)
538—Monro, William Johnston, aged 16, Glasgow Athenæum, Merchant's Clerk—Book-keeping (1st)
75—Moore, Francis Joseph Thomas, aged 24, London M.I., Book-keeper—Book-keeping (3rd)
234—Morrow, David, aged 24, People's Reading Rooms, Belfast, Clerk—Book-keeping (3rd)
259—Moss, Henry, aged 19, Leeds Young Men's Christian I., Stuff Salesman—French (3rd); German (2nd)
93—Mumford, John, aged 20, Pembroke Dock M.I., Shipwright—Arithmetic (3rd)
255—Myers, Thomas, aged 20, Leeds Young Men's Christian I., Clerk—Arithmetic (1st); Book-keeping (1st) with 1st Prize; Algebra (3rd); Geometry and Mensuration (1st)
406—Nash, Harriet, aged 23, Bristol Athenæum, Governess—French (2nd)
528—Nash, Robert George, aged 39, Crosby Hall Evening Classes, Clerk—Arithmetic (3rd); Book-keeping 3rd)
48—Neil, Thomas, aged 19, Glasgow M.I., Warehouseman—Chemistry (3rd)
5—Nesbit, Thomas, aged 24, S.E. Railway M.I., Ashford, Railway Clerk—Arithmetic (1st); Book-keeping (1st)
451—Norcliffe, James Carr, aged 25, Working Men's College, Halifax, Carpet Weaver—Algebra (3rd)
341—Nuttall, John, aged 18, Bradford M.I., Warehouseman—Algebra (3rd); Geometry and Mensuration (3rd)
266—Oldroyd, Linley, aged 16, Leeds Young Men's Christian I., Architect—Arithmetic (1st); Algebra (3rd)
51—Palethorpe, John, aged 20, Glasgow M.I., Clerk—Arithmetic (1st) with 1st Prize
3—Parkin, Benjamin, aged 17, Working Men's I., Ashburne, Organist—Music (3rd)
507—Parry, John, aged 21, Liverpool Collegiate I., Slate Quarryman—Book-keeping (3rd)
486—Parry, William, aged 21, Liverpool Collegiate I., Book-keeper—Arithmetic (3rd); Book-keeping (3rd)
49—Patrick, Joseph, aged 22, Glasgow M.I., Clerk—French (1st)
323—Payne, George, aged 20, Manchester M.I., Clerk—Book-keeping (3rd)
7—Payne, James, Jun., aged 21, Blandford L.I., Attorney's Clerk—Geometry and Mensuration (3rd)
383—Pearson, Howard Shakspeare, aged 20, Birmingham and Midland I., Merchant's Clerk—French (2nd)
493—Petterson, Richard Daniel, aged 17, Liverpool I., Clerk—Arithmetic (3rd)
138—Phelan, Edmond, aged 16, Waterford M.I., Draper—Arithmetic (2nd)
177—Philip, Anthony Gowan, aged 22, Aberdeen M.I., Apprentice Clerk—French (2nd)
267—Pickard, Alfred, aged 17, Leeds Young Men's Christian I., Clerk—Geometry and Mensuration (1st) with 2nd Prize; Trigonometry (2nd)
250—Pickard, John Wood, aged 24, Leeds Young Men's Christian I., Railway Clerk—Arithmetic (2nd); Book-keeping (1st)
278—Platt, James, aged 18, Leeds Young Men's Christian I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
303—Pogson, John, aged 27, Manchester M.I., Clerk—Conic Sections (3rd); Statics, &c. (2nd)
508—Potter, Frederick William, aged 19, Crosby Hall Evening Classes, Clerk—Book-keeping (2nd); Algebra (3rd)
392—Potter, George Nathaniel, aged 23, Birmingham and Midland I., Brass-founder—English History (2nd)
506—Price, Samuel, aged 19, Liverpool Collegiate I., Clerk—Arithmetic (3rd)
296—Price, William Elias, aged 19, Leicester Church of England I., Clerk—Arithmetic (1st); Algebra (3rd)
52—Primrose, James, aged 20, Glasgow M.I., Working Engineer—Algebra (3rd); Geometry and Mensuration (2nd)
405—Ratcliffe, Mary Matilda, aged 21, Bristol Athenæum—French (2nd)
191—Reed, John, aged 24, West Hartlepool L. and M.I., Clerk—Arithmetic (3rd); Book-keeping (3rd)
520—Rees, Alfred Thomas, aged 17, Crosby Hall Evening Classes, Clerk—Arithmetic (2nd); Latin and Roman History (3rd)
510—Rennick, Charles, aged 23, Crosby Hall Evening Classes, Mercantile Clerk—Arithmetic (3rd); Book-keeping (3rd)
285—Richardson, Charles Luke, aged 22, Leeds Young Men's Christian I., Cloth-drawer—French (3rd)
53—Richardson, James, aged 21, Glasgow M.I., Stationer—French (1st)
430—Richmond, Alexander, aged 17, Glasgow Athenæum, Clerk—Arithmetic (2nd); French (1st)
419—Riley, Alexander, jun., aged 19, Glasgow Athenæum, Merchants' Clerk—Book-keeping (2nd)
54—Rintoul, Robert, aged 20, Glasgow M.I., Clerk—French (2nd)
172—Robb, William, aged 21, Aberdeen M.I., Engineer—Algebra (3rd)
396—Robbins, Thomas, aged 19, Birmingham and Midland I., Clerk—Geography (3rd)
338—Roberts, Joseph Seed, aged 18, Bradford M.I., Cabinet-maker—Geography (1st); English History (2nd)
69—Roberts, William, aged 26, Holmfirth M.I., Woollen Cloth Weaver—Arithmetic (3rd); Algebra (3rd); Music (3rd)
371—Robertson, John, aged 26, York I., Porter—Book-keeping (3rd)
287—Robey, Edward, aged 29, Leicester Church of England I., Schoolmaster—Arithmetic (3rd)
254—Robinson, Charles, aged 22, Leeds Young Men's Christian I., Warehouseman—English History (3rd); English Literature (2nd)
263—Robinson, Joseph, aged 18, Leeds Young Men's Christian I., Clerk—Algebra (3rd)

249—Robinson, Walter, aged 21, Leeds Young Men's Christian I., Mechanic—Arithmetic (3rd)
55—Roger, John Maclaren, aged 17, Glasgow M.I., Engineer—Arithmetic (2nd)
204—Roney, John, aged 17, Louth M.I., Attorney's Clerk—English Literature (3rd)
270—Rose, John, aged 22, Leeds Young Men's Christian I., Book-keeper—Book-keeping (3rd)
318—Royle, William Alfred, aged 18, Manchester M.I., Architect—Geometry and Mensuration (3rd)
471—Rudler, Frederick William, aged 18, Royal Polytechnic Inst. Classes, Solicitor's Clerk—Electricity, Magnetism, &c. (1st) with 1st Prize
223—Rundell, Joseph Benjamin, aged 25, Pimlico Literary I., Clerk—Geometry and Mensuration (1st) with 1st Prize.
431—Runciman, William Aitchison, aged 19, Glasgow Athenæum, Clerk—Arithmetic (2nd); Latin and Roman History (1st) with 2nd Prize
56—Russell, George, aged 19, Glasgow M.I., Mechanical Engineer—Geometry and Mensuration (3rd); Practical Mechanics (2nd)
251—Saville, James Walker, aged 17, Young Men's Christian I., Leeds, Clerk—Geography (3rd)
311—Saunders, George Henry, aged 23, Manchester M.I., Draper—French (2nd)
59—Scott, Alexander, aged 21, Glasgow M.I., Book-keeper—Algebra (2nd)
276—Scott, John Thomas, aged 17, Leeds Young Men's Christian I., Merchant's Clerk—Arithmetic (3rd); Algebra (3rd)
163—Shanks, William Henderson, aged 20, Aberdeen M.I., Clerk—Book-keeping (3rd)
407—Shapland, Catharine Elizabeth, aged 21, Bristol Athenæum—German (2nd)
364—Share, Holditch Hamnett, aged 23, Lynn Athenæum, Merchant's Clerk—Book-keeping (2nd)
366—Shaw, Samuel William, aged 18, Stanley Library, Lynn, Clerk—Arithmetic (3rd); Book-keeping (1st)
244—Shaw, Wilson, aged 16, People's Reading Rooms, Belfast, Clerk—Book-keeping (3rd)
77—Shinn, Thomas, aged 17, London M.I., Clerk—Chemistry (2nd)
118—Shutt, Richard, aged 36, People's College, Sheffield, Saddler—Arithmetic (1st); Latin and Roman History (3rd)
397—Simpson, Henry, aged 18, Messrs. Chance's Library and Reading Room, Birmingham, Clerk—Arithmetic (1st); Bookkeeping (1st) with 2nd Prize
435—Simpson, William, aged 18, Glasgow Athenæum, Clerk—Bookkeeping (2nd)
82—Sinclair, Richard, aged 21, Newcastle Church of England I., Clerk—Book-keeping (2nd)
67—Smith, David, aged 18, Glasgow I., Mechanic—Geometry and Mensuration (3rd)
442—Smith, Henry, aged 18, Working Men's College, Halifax, Warehouseman—Arithmetic (2nd); English Literature (3rd)
179—Smith, James Dear, aged 18, Aberdeen M.I.—Statics, &c. (2nd)
354—Smith, Joseph, aged 22, Bradford M.I., Overlooker—Arithmetic (3rd); Book-keeping (3rd)
65—Smith, William, aged 16, Glasgow I., Junior Clerk—Book-keeping (3rd)
230—Smith, William, aged 16, People's Reading Rooms, Belfast, Assistant Teacher—Arithmetic (2nd); Geography (2nd)
470—Solomons, Albert Elias, aged 19, Royal Polytechnic Inst. Classes, Colonial Merchant—Chemistry (2nd).
185—Souttar, James, aged 19, Aberdeen M.I., Architect—Arithmetic (3rd)
369—Sowden, Thomas Henry, aged 18, York I., Railway Clerk—Arithmetic (1st)
488—Spencer, Henry, aged 18, Halifax M.I., Stock-keeper—Arithmetic (3rd)
447—Spencer, James, aged 25, Working Man's College, Halifax, Porter—Algebra (3rd)
519—Stainburn, George, aged 17, Crosby Hall Evening Classes, Clerk in Customs—English History (3rd)
83—Stanger, John, aged 28, Newcastle Church of England I., Butler—Book-keeping (3rd)
215—Stead, William, aged 22, Selby M.I., Schoolmaster—Arithmetic (3rd); Geography (3rd)
512—Stevens, Daniel Collenette, aged 23, Crosby Hall Evening Classes, Shipbroker—Music (3rd)
531—Stevens, John, aged 30, Crosby Hall Evening Classes, Clerk—Arithmetic (3rd)
57—Stewart, Thomas, aged 19, Glasgow M.I., Clerk—French (2nd)
317—Storer, Joseph, aged 20, Manchester M.I., Book-keeper—Book-keeping (3rd)
499—Sutcliffe, William James, aged 19, Liverpool Collegiate I., Clerk—Arithmetic (2nd); Book-keeping (3rd)
58—Sutherland, John, aged 17, Glasgow M.I., Clerk; Arithmetic (3rd)
461—Swaine, James, aged 18, Frome M.I., Chemist and Druggist—Arithmetic (3rd); Algebra (3rd)
109—Taylor, John, aged 26, Sheffield People's College, Stag-horn Cutter—Latin and Roman History (3rd)
388—Taylor, Reuben, aged 34, Birmingham and Midland I., Law Clerk—English Literature (3rd)
61—Tennent, James Binnie, aged 18, Glasgow M.I., Clerk—Arithmetic (2nd)
264—Tetley, George, aged 17, Leeds Young Men's Christian I., Clerk—Music (3rd)
265—Tetley, William Henry, aged 20, Leeds Young Men's Christian Institution, Stationer and Bookseller—English History (3rd); English Literature (1st)
414—Thomas, Richard Coupland Fleming Antonio, aged 17, Bristol Young Men's Christian Association, Clerk—Arithmetic (3rd); Algebra (3rd)
97—Thomas, Thomas Samuel, aged 17, Richmond Young Men's Society, Tailor—Geography (3rd)
133—Thompson, William Sparrow, aged 20, Waterford M.I., Lithographer—Arithmetic (2nd)
60—Thompson, James, aged 28, Glasgow M.I., Clerk—Arithmetic (1st); Book-keeping (3rd); Statics, &c. (3rd);
413—Tovey, Duncan Crookes, aged 17, Bristol Athenæum—Arithmetic (2nd); Algebra (3rd); Latin and Roman History (1st) with 1st Prize; English Literature (1st) with 2nd Prize
360—Turnbull, John, aged 18, Church of England L.I., Carlisle, Clerk—Arithmetic (3rd)
120—Turner, John, aged 17, People's College, Sheffield, Wire-worker—Arithmetic (3rd)
252—Turner, Thomas Burton, aged 19, Leeds Young Men's Christian I., Solicitor's Clerk—Arithmetic (1st); French (2nd)
545—Unsworth, William, aged 31, Bury Athenæum, Boot and Shoe Maker—Music (2nd)
106—Wade, Henry, aged 27, People's College, Sheffield, Clerk of Works—Arithmetic (3rd)
549—Wade, Robert, aged 20, Skipton M.I., Grocer's Assistant—Algebra (3rd)
319—Wadsworth, Alfred, aged 17, Manchester M.I., Engineer—Arithmetic (3rd)
444—Walker, John, aged 19, Working Men's College, Halifax, Woollen Spinner—English Literature (3rd)
315—Walker, Wm. aged 20, Manchester M.I., Draper's Apprentice—Book-keeping (3rd); Political Economy (3rd)

62—Wallace, Andrew, aged 23, Glasgow M.I., Clerk—Arithmetic (2nd)

433—Wallace, John Scott, aged 21, Glasgow Athenæum, Clerk—Book-keeping (3rd)

464—Walshaw, Thomas, aged 18, Young Men's Christian I., Leeds, Clerk—Book-keeping (3rd)

193—Watson, Robert Long, aged 16, West Hartlepool L. and M.I., Clerk—Book-keeping (3rd)

63—Watt, Alexander, aged 22, Glasgow M.I., Clerk—Arithmetic (3rd); Geometry and Mensuration (3rd)

161—Webster, John, aged 18, Aberdeen M.I., Pattern-maker—Arithmetic (3rd); Algebra (3rd)

94—Whipple, George Mathews, aged 16, Richmond Parochial Library, Junior Assistant at the Observatory, Kew—Arithmetic (2nd); Geography (3rd)

443—Whitaker, Robert, aged 18, Working Man's College, Halifax, Yarn Singer—English Literature (3rd)

279—White, John, aged 18, Young Men's Christian I., Leeds, Machine-maker—Arithmetic (3rd)

352—White, Thomas, aged 18, Bradford M.I., Warehouse Boy—Arithmetic (3rd)

218—Whitehead, William, aged 19, Selby M.I., Book-keeper—Book-keeping (3rd); Geography (2nd)

389—Whitfield, George James, aged 21, Birmingham and Midland I., Surveyor's Clerk—English History (1st)

131—Whitworth, Edwin Charles, aged 25, Church of England Educational I., Sheffield, Cashier—Latin and Roman History (2nd)

330—Wicker, George William, aged 19, Watt Institute, Portsea, Engineer—Book-keeping (2nd); Geography (3rd); French (3rd)

89—Wiele, Augustus Meymott, aged 30, Pembroke Dock M.I., Clerk, Geography (2nd); English History (1st) with 2nd Prize.

351—Wilcock, William, aged 26, Bradford M.I., Estate Agent's Clerk—Animal Physiology (3rd); German (3rd); English Literature (3rd)

127—Wiles, Joseph Jarvis, aged 24, Church of England Educational I., Sheffield, Warehouseman—Arithmetic (2nd)

379—Willis, William, aged 18, Birmingham and Midland I., Mechanical Engineer—Algebra (3rd); Geometry and Mensuration (2nd)

117—Wilson, John, aged 37, People's College, Sheffield, Pen-blade Grinder—Political Economy (2nd); English Literature (3rd)

238—Wilson, Thomas Henry, aged 20, People's Reading Rooms, Belfast, Clerk—Arithmetic (3rd); Book-keeping (3rd)

108—Winder Edmund, aged 33, People's College, Sheffield, Land Surveyor—Geometry and Mensuration (3rd)

101—Wing, John Unwin, aged 18, People's College, Sheffield, Clerk—Arithmetic (3rd); Book-keeping (2nd)

533—Wood, George, jun., aged 33, Crosby Hall Evening Classes, Book-keeper—English History (2nd); French (2nd)

328—Wood, Joseph, aged 17, Manchester M.I., Clerk—Book-keeping (3rd)

358—Wood, Thornton, aged 18, Bradford M.I., Woolsorter—Arithmetic (2nd)

123—Wood, William Martin, aged 30, People's College, Sheffield, Grocer—Political Economy (1st) with 1st Prize; English Literature (3rd)

88—Woodhead, Samuel, aged 32, Northowram M.I., Book-keeper—Arithmetic (2nd); Book-keeping (3rd); Algebra (3rd)

332—Woodman, Samuel James, aged 16, Watt I., Portsea, Engineer's Apprentice—Arithmetic (1st); Algebra (3rd); Geometry and Mensuration (3rd)

74—Woods, Richard Edmund, aged 19, London M.I., Ironmonger—Geography (2nd)

375—Woodward, Charles Josiah, aged 20, Birmingham and Midland I., Chemical Teacher's Assistant—Chemistry (1st) with 1st Prize.

72—Woolnough, Walter William, aged 18, London M.I., Clerk—Arithmetic (3rd); French (3rd)

64—Worth, Charles, aged 22, Glasgow M.I., Royal Engineers—Algebra (3rd); Chemistry (2nd)

22—Wren, William, aged 39, Carshalton Mutual Improvement Society, Gardener—Arithmetic (3rd); Botany (3rd)

271—Wright, John, aged 24, Leeds Young Men's Christian I., Teacher—Algebra (3rd)

345—Wroe, John Clark, aged 18, Bradford M.I., Wool-sorter—Arithmetic (3rd)

190—Zachariah, John Allison, aged 24, L. and M.I., West Hartlepool, Watchmaker—Arithmetic (3rd); Book-keeping (3rd)

To Correspondents.

Letters from Mr. H. F. Chorley, and from Mr. Henry Reveley on the "Uniform Musical Pitch" have been received, as well as Mr. Dugald Campbell's letter "On the Relative Values of Coal and Coke, in reply to the letter signed "I.," in last week's *Journal*, but they are unavoidably omitted this week for want of space.

Erratum.—In last number, page 501, col. 2, line 27, for "132" read "13."

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Brit. Architects, 8.
Geographical, 8½. Capts. R. F. Burton and J. H. Speke, "Explorations in Eastern Africa."

Tues. ......Royal Inst., 3. Professor John Morris, "On Geological Science."
Syro-Egyptian, 7½. I. Dr. Lee, Messrs. Sharp and Bonomi, "On the Ancient Egyptian Cubit of the Louvre, and the Palette of an Ancient Theban Scribe, in the Hartwell Museum." II. Mr. J. Bonomi, "Extracts from the Journals of English Residents at Ghadarmes and Diarbekir."
Medical and Chirurg., 8½.

Wed. ......Geological, 8½.
Ethnological, 8½.

Thurs .....Royal Inst., 3. Mr. Austen H. Layard, "On the Seven Periods of Art."
Linnæan, 8. I. Prof. Anderson, "On the East Indian *Salices*." II. Rev. Mr. Foulkes, "On the Cultivation' of the Cocoa-nut in Ceylon." III. Mr. B. Clarke, "On Monocotyledonous Embryos." IV. Mr. Spence, "On *Leopoldina piassaba;* the Palm producing the 'Piassaba of the Rio Negro."
Chemical, 8.

Fri. ......Royal Inst., 8½. Prof. Faraday, "Becquerel's Phenomena of Phosphorescence."

Sat..........Asiatic, 2.
Royal Inst. 3. Mr. J. P. Lacaita, "On Modern Italian Literature."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 3rd*, 1859.]

Dated April 30th, 1859.

1088. A. McKechnie, Carron, Stirling, N.B.—Imp. in hammers and in apparatus for working the same.

Dated 5th May, 1859.

1128. E. T. Hughes, 123, Chancery-lane—Imp. in the manufacture of sheet iron. (A com.)

Dated 6th May, 1859.

1142. T. Jones, Liverpool—An improved apparatus and arrangement of flues for heating and ventilating buildings, ships, and other structures, and for causing draughts in chimnies.

Dated 9th May, 1859.

1160. F. V. Hadlow, 8, Prince Albert-street, Brighton—An improved stamp for marking linen and other wearing apparel.
1162. A. V. Newton, 66, Chancery-lane—An improved construction of lamp. (A com.)
1164. E. T. Hughes, 123, Chancery-lane—Imp. in obtaining motive power. (A com.)
1166. N. Barker, Heyford, and J. A. Carter, Blisworth, Northamptonshire—Imp. in apparatus for lubricating the pistons of steam engines.

Dated 10th May, 1859.

1168. R. J. Lees, Woolley Bridge, near Hadfield, Derbyshire—Imp. in steam generators or boilers.
1170. M. Defries, Houndsditch—Improved apparatus for regulating the pressure of gas.
1172. R. Thomson, Glasgow—Imp. in shuttles.
1174. M. Henry, 84, Fleet-street—Imps. in heating and in supplying air, and in the apparatus employed therein, part of which improvements is also applicable to exhausting fluids. (A com.)

Dated 11th May, 1859.

1178. A. Manbré, 10, Rathbone-place, Oxford-street—An improved method of extracting and purifying sugar, called glucose and 'sirop de fecule,' from potatoes or fecula, or starch or dextrine for the purposes and uses of brewers, distillers, vinegar makers, colouring makers, or otherwise.
1180. T. P. Bennett, Gilnow Mills, near Bolton-le-Moors, Lancashire—Certain imps. in or applicable to carding engines.
1182. H. Clarke, Wakefield—Imp. in balancing mill-stones to the running as well as the standing state. (A com.)
1184. C. F. Vasserot, 45, Essex-street, Strand—An improved musrol or noseband for horses' bridles. (A com.)
1186. W. Salter, jun., Lea, Wilts—Imp. in hay-making machines.
1188. J. B. Lyall, Castle Frome, Hereford, and W. Campin, Strand—Imp. in the "saloon" omnibus and other omnibuses, the wheels and springs whereof, and mode of attaching them, being applicable to other carriages.

Dated 12th May, 1859.

1190. J. Saxby, Brighton—Imp. in the mode of securing the rails on railways.
1191. R. A. Brooman, 166, Fleet-street—Imp. in machinery for solidifying, pressing, and moulding. (A com.)
1192. A. P. Rochette, Brighouse, Yorkshire—An imp. in the manufacture of soft soap.

Dated 13th May, 1859.

1196. T. Scott, Rouen, France—An improved surface condenser and refrigerator.
1198. J. F. Allender, Brierley Hill, Staffordshire, and J. Richards, jun.—Imp. in furnaces for puddling iron.
1200. R. Gourlay, Glasgow—Imp. in making moulds for casting.
1202. R. A. Brooman, 166, Fleet-street—Imp. in cooking, preserving, and drying animal and vegetable substances. (A com.)
1204. W. S. Thomson, St. Martin's-le-Grand—Imp. in the manufacture of hooped skirts. (Partly a com.)
1206. G. R. Clover, Liverpool—Imp. in ships' night signals.

Dated 14th May, 1859.

1208. M. Leahy, 53, Hereford-road, Westbourne park—Imp. in apparatus for facilitating the draught of carriages.
1210. D. Smith, Glasgow—Imp. in projectiles for fire-arms.
1212. E. Maw, Doncaster Iron Works, Yorkshire—Imp. in the construction of buildings made of iron or other metals.

Dated 16th May, 1859.

1214. S. C. Sheard, Smethwick, Staffordshire—Certain imp. in fire-bars, which are applicable to all furnaces where great heat and economy of fuel are required.
1216. W. Midworth, Newark-upon-Tent, Nottinghamshire—An improved iron for the use of laundries, tailors, or other purposes.
1218. J. Clark, Glasgow—Imp. in envelopes, and in machinery or apparatus for gumming, embossing, folding, counting, and otherwise treating the same, in part applicable in the treatment of note and other writing paper.
1220. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in mixing, combining, and otherwise treating certain matters and substances for the production of manure. (A com.)

Dated 17th May, 1859.

1222. L. D. Owen, 192, Tottenham Court-road—An improved menstrual receiver or truss. (A com.)
1223. J. Brown, jun., Rotherham, Yorkshire—Imp. in buffers, draw springs, and bearing springs.
1224. A. R. L. P. Gras, and A. L. A. Boucherie—Distilling schist or boghead coal and other minerals for lighting.
1225. H. Dolley, Paris—An imp. in the manufacture of hooped petticoats, and in the metal ribs employed in the manufacture of hooped petticoats.
1226. A. E. C. J. Reynaud de Trets, Marseilles—An improved composition for splitting rock.
1227. J. Nasmyth, Surrey-street, Strand—Improved apparatus for obtaining and applying motive power.
1228. C. Law, Wolverhampton—Imp. in the construction of locks.

Dated 18th May, 1859.

1229. R. Romaine, Chapel-street, Bedford-row—Imp. in the means of applying steam power to the cultivation of the soil.
1231. E. Charlesworth, 3, King William-street, Strand—Counteracting the recoil of small fire-arms, and lessening the risk of injury arising from the bursting of the same.
1232. S. N. Evans, Chapel-yard, North-street, Wolverhampton—Improved mechanism for preventing accidents at mines from overwinding.
1233. J. Haslam, Preston—An improved construction of healds or harness used in warp dressing and sizeing machines, and in looms for weaving.
1235. J. Dean, J. Parkinson, E. Riley, and W. Burton, Syke Mill, Haslingden, Lancashire—Imp. in certain self-acting mules for spinning fibrous materials.
1236. W. Nicholls, Tregolls road, Truro, Cornwall—Imp. in portable corn mills.
1237. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in lubricating certain portions of machinery. (A com.)
1238. R. A. Brooman, 166, Fleet street—Imp. in heating. (A com.)
1239. J. Childs, Windsor-house, Putney—Imp. in hardening and vulcanizing compounds of sulphur with india rubber and gutta percha.

Dated 20th May, 1859.

1240. J. Valda, London—Imp. in stud fastenings, and a system of ornamenting and adapting belts, cravats, ribbons, draperies, and other articles to stud fastenings.
1241. G. Walker, Old Nickol's-street, Church-street, Shoreditch—Certain imp. in swing looking-glasses.
1242. R. Wilson, Patricroft, near Manchester— hydraulic machinery.
1243. H. Newman, Liverpool—Imp. in the construction of artificial teeth, and in the mode or manner of affixing the same to the frame.
1245. R. V. Leach, Taibach, Glamorganshire—Imp. in the manufacture of iron, and in the machinery connected therewith.
1246. D. Kirkaldy, Glasgow—Imp. in the manufacture or treatment of steel.
1247. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the roasting or calcining of ores, applicable also to the oxidising of other substances. (A com.)
1248. W. Teasdel, Pier, Great Yarmouth—Imp. in coffer dams.
1250. J. P. Budd, Ystalyfera, near Swansea—Imp. in the manufacture of tin and terne plates.
1251. W. C. Cambridge, Bristol—Imp. in thrashing and winnowing machines.

Dated 21st May, 1859.

1253. J. R. Scartliff, Wolverhampton—Imp. in the construction of lubricating and other cans, in order to regulate the discharge or flow of the liquids they contain.
1254. J. Thompson, Witton, near Northwich, Cheshire, and J. Thompson, jun., the Castle, Northwich—The manufacture of salt by an improved and more economical mode.
1255. A. V. Newton, 66, Chancery-lane—An improved construction of cartridge. (A com.)
1256. W. P. Savage, Roxham, Downham Market, Norfolk—Imp. in traction steam engines and machinery for moving agricultural implements and machines.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, June 3rd*, 1859.]

June 2nd.

2556. D. Frodsham.
2774. J. B. Fisher, J. Fisher, and J. Bird.
2781. H. T. Yates.
2793. D. B. White.
2794. R. A. Brooman.
2808. J. Ferrabee and F. H. England.
2847. M. Schaffner.
2856. R. A. Brooman.
2858. J. Ferrabee.
2870. F. C. N. J. Viellard-Migeon.
2904. E. Weber.
2963. H. Lowe, W. Trueman, and J. L. Pitts.
59. W. E. Newton.
153. R. Garrett, jun., and J. Kerridge.
177. W. E. Newton.
463. S. Wheatcroft.
654. B. Rider.
734. J. Macintosh.

[*From Gazette, June 7th*, 1859.]

June 7th.

2797. J. E. Boyd.
2810. G. F. Chantrell.
2815. A. Lamb & W. A. Summers.
2819. R. L. Burrowes & J. Knowles, jun.
2820. J. Barrow, jun.
2822. J. Eccles.
2825. J. Elder.
2826. J. Stewart.
2827. T. Allen.
2829. H. Wilson.
2830. E. L. Pensuete.
2843. S. Dudgeon.
2869. H. Bridges.
13. W. Eccles.
104. C. N. May.
159. W. A. F. Powell.
647. T. Patstone.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June 3rd*, 1859.]

May 30th.

1298. T. Wilson.

[*From Gazette, June 7th*, 1859.]

June 2nd.

1424. J. Davis.

June 3rd.

1314. G. J. Mackelcan.
1333. D. Morrison.

June 4th.

1363. C. W. Siemens.
1419. W. H. Barlow and W. H. Woodhouse.
1331. E. Rogers & H. Mackworth.

Journal of the Society of Arts.

FRIDAY, JUNE 17, 1859.

EIGHTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Eighth Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on TUESDAY, the 28th inst. at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, as soon as possible, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference.

The following letter has been addressed to the Institutions and Local Boards :—

Society of Arts, Manufactures, and Commerce,
11th June, 1859.

Sir,—I am directed by the Council to inform you that the Eighth Annual Conference with the Representatives of the Institutions in Union will be held here on Tuesday, June the 28th, at 10 o'clock precisely. Mr. C. Wentworth Dilke, the Chairman of the Council, will preside.

The Council hopes that your Institution (or Local Board of Examiners) will not fail to appoint a representative to attend the Conference; and that you will communicate to me, at your earliest convenience, the name of the Representative appointed. The Council will lay before the Conference a report of the proceedings of the Union during the year now about to end, and a programme of the Examinations for 1860. Among the questions which the Council will propose to the Conference for consideration are the following :—

1. What arrangements can be made to enable the smaller and poorer Institutes to profit by the Examinations without loss to the Society of Arts?
2. Is it expedient to further define and prescribe the constitution and modes of action of the Local Boards?
3. Is it expedient to continue the system of giving prizes in addition to the certificate?
4. Would the Institutions, at their own cost, wish to receive, according to a rota, for local Exhibition, collections of some of the more portable and useful of the articles that are annually exhibited by the Society of Arts?
5. Can the Museums and Galleries in the metropolis, which are the property of the public, or subsidised from the public funds, be rendered useful to the Institutions in different parts of the country, by systematically lending to them specimens for Exhibition, or by granting to them unrequired duplicates?
6. Should an effort be made by the Union to procure the opening of the National Museums and Galleries to the public of an evening?
7. Is it expedient to apply to Parliament to extend to the Institutes and to the Local Boards the operation of the Free Libraries' and Museums' Acts?
8. Is it expedient that the Society of Arts should annually visit some one of the large manufacturing towns where there are Institutes in union with the Society; and, if so, under what circumstances and conditions should such visits be made?
9. Do the Institutions agree with the Council in thinking it desirable to provide at the house of the Society facilities for the admission of members of the Institutions, visitors in London, to the different establishments and objects of public interest accessible gratuitously by ticket, and for seeing which much curiosity is usually felt by strangers?

With reference to the questions numbered 1, 2, 3, and 7, I am to explain that, as the system of previous Examinations by Local Boards, and of Final Examinations by the Society of Arts Central Board has now been tried for two years with great and increasing success, the Council wishes to have it considered whether that system may not now be more perfectly organised.

You will see that these subjects are of no little importance, and the Council of the Society of Arts hopes that you will send a representative prepared to discuss them.

The Council has reason to believe that it may be proposed to the Conference to consider whether it is expedient for the Institutions to ask the Committee of Council on Education to give the Evening Classes of Institutions the Grants which that Committee gives to the Evening Classes which are connected with inspected day-schools.

If there be any other subject which your representative may wish to submit to the conference, it would be convenient that you should give me notice of it.

I shall be obliged by your sending me, by return of post, a copy of your last annual report.

The chair of the Conference will be taken, and the business will begin, punctually at 10 o'clock. At half-past one the Conference will be adjourned for twenty minutes.

The One Hundred and Fifth Anniversary Dinner of the Society will take place at St. James' Hall, Piccadilly, on the same day (Tuesday, the 28th of June), at half-past six for seven o'clock precisely. The Right Honourable Lord Napier will preside. Applications for tickets (price 10s. 6d. each) should be made to Mr. Samuel Thomas Davenport, at the Society's House, Adelphi, London, W.C. The tickets will be ready for delivery on and after the 13th instant.

I am, Sir,
Your obedient Servant,
P. LE NEVE FOSTER, Secretary.

ANNUAL DINNER.

The One hundred and fifth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on TUESDAY, the 28th inst., at half-past six for seven o'clock precisely. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Monday, the 13th instant. The Right Hon. Lord Napier will preside.

ANNUAL GENERAL MEETING.

The one hundred and fifth Annual General Meeting, for the purpose of receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held on Wednesday, the 29th inst., at four o'clock, p.m.

EXAMINATIONS, 1859.

The following Prizes have been awarded to Institutions and Local Boards, in accordance with the conditions* set forth at page 9 of the Examination Programme for this year:—

PRIZES TO INSTITUTIONS.

One Prize of £5 to the Mechanics' Institution, Glasgow, in respect of Candidate No. 51, John Palethorp, who obtained the First Prize in Arithmetic.

One Prize of £5 to the Royal Polytechnic Institution Classes, in respect of Candidate No. 471, Frederick William Rudler, who obtained the First Prize in Electricity, Magnetism, and Heat.

One Prize of £5 to the Birmingham and Midland Institute, in respect of Candidate No. 375, Charles Josiah Woodward, who obtained the First Prize in Chemistry.

One Prize of £5 to the People's College, Sheffield, in respect of Candidate No. 123, William Martin Wood, who obtained the First Prize in Political Economy.

One Prize of £5 to the Mechanics' Institution, Halifax, in respect of Candidate No. 487, William Thomas Dewhirst, who obtained the First Prize in Geography.

One Prize of £5 to the Mechanics' Institution, Glasgow, in respect of Candidate No. 32, William Cree Crawford, who obtained the First Prize in French.

One Prize of £5 to the Crosby Hall Evening Classes, in respect of Candidate No. 514, Samuel Lee Cressall, who obtained the First Prize in German.

No Prizes are awarded to Institutions in respect of the Candidates who obtained First Prizes in Book-keeping, Algebra, Geometry and Mensuration, Trigonometry, Conic Sections, Statics, &c., English History, English Literature, and Latin and Roman History, it having been ascertained that these Candidates had not received "systematic instruction" in these subjects at their respective Institutions "for a period of not less than three months," as required by the conditions.

PRIZES TO LOCAL BOARDS.

The Prize of £10 to the Local Board at the Leeds Young Men's Christian Institute.

The Prize of £8 to the Local Board at Bristol.

The Prize of £6 to the Local Board at the Glasgow Mechanics' Institution.

The Prize of £4 to the Local Board at the Halifax Mechanics' Institution.

The following errors have been pointed out in the list of successful candidates published in last week's *Journal*:—

At page 513, line 24 (No. 408, Charles Payne Evanson), for "Mensuration (2nd)" read "Music (2nd)." At page 511, line 11 from bottom, for "Anty" read "Auty." At page 513, last line but one, for "Hawes" read "Haves."

UNIFORM MUSICAL PITCH.

The Council, in accordance with the powers given to them by the resolution passed at the meeting in reference to this subject, held at the Society's house on Friday, the 3rd instant, have added the following gentlemen to the Committee then appointed:—

Mr. Hobbs.
Mr. G. A. Macfarren.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following is a report of what took place in the House of Lords, on Friday evening last, the 10th inst., in reference to this subject:—

The Earl of Shaftesbury moved for a copy of the correspondence between the Trustees of the National Gallery and the Council of the Society for the Encouragement of Arts, Manufactures, and Commerce with reference to the opening of the Vernon and Turner galleries of pictures at South Kensington of an evening; and also for copies of all letters and memorials on the same subject which may have been received by the said trustees up to the date of their making the returns now moved for.

The Marquis of Salisbury said he should offer no objection to the production of the correspondence.

After a few words from Lord Monteagle,

Lord Overstone said the trustees of the National Gallery sought to promote no other end than that the treasures in their custody should as far as possible be open to the public, and made to contribute to their rational amusement as well as their intellectual improvement. The question of opening picture galleries in the evening was, however, entirely a new one, and before such a step was taken, the effect of gaslight upon the paintings ought to be carefully considered. No national collection of pictures in the world had, he believed, up to the present time been thrown open in the evening; but whether that might be done without any injurious result was, no doubt, a point deserving of attention. He had only to add that he had attended a meeting of the Trustees of the National Gallery on Monday last, when Sir C. Eastlake had undertaken to investigate the question with a view to its solution.

Lord St. Leonard's was of opinion that great danger would result from lighting up the National Gallery or any other of our great picture galleries at night. He could not, also, help remarking that they would, if opened in the evening, be likely to be visited for the purpose of conversation rather than with a view to the inspection of the paintings.

The Earl of Derby said there could be no sort of objection to the papers asked for by his noble friends, but the present was hardly the time for the discussion of the question whether the gallery should be open or not. (Hear, hear.)

Lord Stanley of Alderley did not wish to pronounce an opinion on the propriety of lighting up the gallery with gas, but would remind the House that the Sheepshanks Collection was now exhibited at night, and that a valuable boon was thus granted to persons who had not time to inspect these pictures during the day. He would suggest to the Government whether some plan might not be adopted by which the light should be admitted at the top, as in the House of Commons, so that the fumes of the gas could not injure the pictures. (Hear, hear.)

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* The conditions are as follows:—

"The following Prizes are offered to the Institutions, viz.:—To the Institution whose Candidate obtains the First Prize of £5 in each of the 23 Sub-Divisions of Subjects, one Prize of £5. An Institution can take more than one such Prize: but no such Prize can be taken by an Institution unless the Council of this Society are satisfied that the Candidate, in respect of whom the Prize is claimed, has received at the Institution systematic instruction in the subject for a period of not less than three months.

"The following Prizes are offered to the Local Boards, viz.:—To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than ten) bear the largest proportion to its whole number of Candidates: One Prize of £10.—To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than eight) bear the largest proportion to its whole number of Candidates: One Prize of £8—To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than six) bear the largest proportion to its whole number of Candidates: One Prize of £6.—To the Local Board whose Candidates obtaining Certificates of the first class (not fewer than four) bear the largest proportion to its whole number of Candidates: One Prize of £4.—No Local Board can receive more than one of these Prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted."

The motion was then agreed to.

The following letter has been addressed to the Trustees of the National Gallery, by the Earl of Shaftesbury, as President of the Young Men's Christian Association :—

Young Men's Christian Association, 165. Aldersgate-street,
London, E.C., 26th May, 1859.

Sir,—With reference to the letter addressed by the Council of the Society of Arts to the Trustees of the National Gallery, urging upon them the importance of allowing the several collections of Paintings, which are National property, to be opened to the public during suitable hours in the evening, for the convenience and instruction of the large class of persons whose avocations render it impossible for them to take advantage of the opening of the public Galleries and Museums during the day, I beg, as President of the Young Men's Christian Association, very earnestly to support this appeal for an act of consideration to the multitude of clerks, shopmen, traders, artizans, and others engaged in the active business of life, which will be deeply and gratefully appreciated by them, and which will, apart from its educational value and importance, tend to produce the most valuable moral results.

The experience acquired in the various labours of this Association justifies the assertion, that a large proportion of the follies and vices of young men arise not so much from a mere propensity to indolence and irregularity of conduct, as from the very general privation of social and domestic comforts, and the absence of opportunities for safe and suitable recreations and enjoyments.

To secure to them, therefore, the advantage of free access, in their leisure hours, to our National Museums and Galleries, will be to provide a most salutary check to the influence of evil habits, and, in improving the moral tone and character of this large class of the community, to elevate the manners and increase the comforts of society at large.

Its bearing upon those aspects of sanitary reform which are associated with the character and condition of the dwellings of the people, is scarcely less important; and upon all these grounds I most earnestly commend the desired alteration to the most favourable consideraation of the Trustees of the National Gallery.

I am, Sir,
Your obedient servant,
(Signed) SHAFTESBURY.

The Secretary to the
Trustees of the National Gallery.

SPANISH EXHIBITION.

An Exhibition of Industry is appointed to be held in Madrid in 1862. It will be confined to the products of Spain, Portugal, and the American Republics of Spanish origin.

MANUFACTURES, PROPERTIES, AND APPLICATION OF WATER GLASS, INCLUDING A PROCESS OF STEREOCHROMIC PAINTING.

By Dr. Johann Nep. Fuchs.

(*Translated by desire of and communicated by H.R.H. the Prince Consort, President of the Society of Arts.*)

In 1825 I had an opportunity of publishing a paper on water-glass, which at that time, however, did not meet with the attention which the subject well deserved. It was even stated that it differed in no respect from the well-known "liquor silicum," and consequently was nothing new. A few voices only were raised in its favour, auguring well for its future. Some experiments on its intended application were made, but abandoned as soon as they did not lead to satisfactory results, undertaken as they were without the necessary knowledge or understanding. Great were the expectations raised by the discovery, greater often than in the nature of things could be realized. Failures, owing perhaps to faulty manipulation, frequently caused it to be abandoned before it had been put to a fair test. There are always persons to be found, who, themselves unable to carry on experiments, are always ready to condemn those of others upon the faith of a single experiment in which they failed, as I have experienced myself more than once.

An inert love of the customary and habitual, almost invariably exerted the usual adverse influence; for it seems to to be the fate of anything new to be looked upon with aversion for some time before it is appreciated.

A few years have changed much, and it has been thought since that the water-glass, after all, did not belong to the class of superfluous things, and that few other bodies were capable of being put to so many various applications. I have naturally taken considerable interest, and have had a share in several applications and experiments made with a view of advancing this affair, and was therefore induced to write this pamphlet while life is still spared me, in order to render the experience gained by myself and others available for further investigations.

The manufacture and the properties of the water-glass have been described at some length in Kastner's Archiv*. I have, however, thought it desirable to reproduce the more essential parts of that paper, since I am able to introduce many improvements, and to treat more amply of things which at that time met only with a short indication.

Section I.

Various Kinds of Water-Glass, and their Manufacture.

We have to distinguish four kinds of water-glass :— a. Potash water-glass. b. Soda water-glass. c. Double water-glass. d. Fixing water-glass.†

At first, and for some time afterwards, my attention was merely directed to potash water-glass,‡ and as nearly all the experiments which I shall have to mention were made with it, I may as well state that potash water-glass is meant whenever the expression water-glass is employed.

Manufacture of Potash Water-glass.

A mixture of 15 parts of pulverized quartz, or pure quartz sand,
,, ,, 10 parts of well-purified potash,
,, ,, 1 ,, powdered charcoal, may be conveniently employed.

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* See Kastner's Archiv for Natural Philosophy of 1825, vol. v. p. 385—412. Separately printed by Leonhard Schrag, of Nüremberg, with the title : On a new product from Silica and Potash, by Dr. Johann Nep. Fuchs, Professor of Mineralogy.

† The name "water-glass" is, infact, a generic name employed when speaking of the above four varieties. I do not know whether a lithia water-glass might be obtained. Perhaps a good double water-glass of potash and lithia might be produced by replacing a part of the potash by lithia, for which purpose lepidolite could be conveniently employed. This double water-glass would no doubt be rather expensive ; cases might, however, occur where expense would be a matter of secondary importance.

‡ M. F. Fikentscher, chemical manufacturer of Zwickau, in Saxony, was the first to manufacture water glass on a somewhat larger scale, and of the best quality. He would no doubt manufacture soda water-glass also, if required, of an equally good quality and at a cheap rate.

These ingredients are to be well mixed and exposed to a strong heat in a fire-proof melting-pot for five or six hours, until the whole fuses uniformly and steadily: as much heat is required as is necessary to melt common glass. The melted mass is then taken out by means of an iron spoon, and the melting-pot immediately refilled with a fresh quantity. It is then broken up, pulverized, and dissolved in about 5 parts of boiling water, by introducing it in small portions into an iron vessel and constantly stirring the liquid, replacing the water as it evaporates, by adding hot water from time to time, and continuing to boil for three or four hours, until the whole is dissolved,—a slimy deposit excepted,—and until a pellicle begins to form on the surface of the liquid, which indicates that the solution is in a state of great concentration; it disappears, however, when the liquid is stirred; and the boiling may then be continued for a short time, in order to obtain the solution in the proper state of concentration, when it has a specific gravity of from 1·24 to 1·25. In this state it is sufficiently liquid to be used in many operations; in some instances it will be necessary to dilute it with more or less water. When evaporated to a syrupy consistence, it can be employed with advantage in but few cases.

Very frequently it is found contaminated with a little sulphide of potassium, and it becomes necessary to add a little oxide of copper or copper scales towards the end of the boiling, which liberates a small quantity of potash, but which renders it rather more suitable for many practical purposes than otherwise. If it is desirable, however, to have a water-glass which is entirely neutral, it requires to be boiled with freshly-precipitated silica as long as any silica is dissolved.

Freshly precipitated or gelatinous silica offers, in fact, the best and most convenient means of ascertaining whether a sample of water-glass is completely saturated with silica, by introducing it in small portions into the boiling liquid, when a saturated solution will dissolve no more, whilst an incompletely saturated solution takes up more or less.

Litharge may also be employed instead of oxide of copper, in order to remove the sulphide of potassium, but requires to be added with great care, since an excess causes the water-glass to coagulate.

The solution is allowed to cool, and left to clear in the well-closed iron vessel. The clear liquid is then decanted off from the deposit (which may serve as a good manure) and filled into stoppered bottles or carboys, and kept for use under the name of potash water-glass.

It may also, for better transport, be evaporated to a gelatinous mass by constantly stirring the liquid, and then packed into tinned iron vessels.

Alcohol furnishes even a more ready means of preparing it in a solid state. By adding one-fourth volume of rectified spirits of wine to a concentrated solution, a gelatinous precipitate is produced, which strongly contracts after a few days, and is deposited on the bottom of the vessel in a solid mass. If the supernatant liquid, which very frequently contains a little carbonate of potash, traces of chloride of potassium, chloride of sodium, and sulphide of potassium, be decanted, and the deposit slightly washed with cold water and squeezed, the water-glass is obtained in a solid and very pure state, and completely saturated with silica. Water dissolves it easily and completely.

Manufacture of Soda Water-glass.

Soda water-glass is prepared in the same way as potash water-glass; but since soda is capable of saturating more silica than carbonate of potash, it is evident that an equal quantity of quartz requires less carbonate of soda.

A mixture of—

45 lbs. of quartz,
23 ,, ,, anhydrous carbonate of soda,
3 ,, ,, charcoal dust.

may be employed for a large charge.

The mixture fuses somewhat easier than potash water-glass. Professor Buchner has found that it can be prepared cheaper by means of Glauber's salt or sulphate of soda, in the proportion of—

100 parts of quartz,
60 ,, ,, anhydrous sulphate of soda
15-20 ,, ,, charcoal dust.

When the mass is completely saturated with silica, it gives with water a somewhat more opaque liquid than the glass prepared from potash in a like state of concentration.

Rectified alcohol does not precipitate it completely like potash water-glass, merely converting it into a gelatinous mass, and giving no precipitate at all, or only after a short time, when it is not completely saturated with silica. or when slightly diluted. This deportment enables us easily to distinguish it from potash water-glass.

Manufacture of Double Water-glass.

Potash and soda water-glass are miscible in all proportions. A mixture of equal equivalents of potash or soda, however, must be considered to furnish the normal double water-glass, which is invariably obtained when 100 parts of quartz and 121 of seignette salt are fused together. This method being too expensive for all practical purposes, may be modified by employing equal equivalents of nitrate of potash, nitrate of soda, and the corresponding amount of quartz, which furnish a cheap glass suitable for all technical applications. It may also be prepared by fusing together quartz, carbonate of potash, and carbonate of soda in the following proportions:—

100 parts of quartz.
28 ,, ,, purified potash.
22 ,, ,, neutral anhydrous carbonate of soda.
6 ,, ,, powdered charcoal.

This mixture is much easier to fuse than any of the previous ones.

A mixture of three measures of concentrated potash water-glass with two measures of concentrated soda water-glass, producing a soluble double water-glass, will be found to answer for all practical applications.

Fixing Water-glass and its Manufacture.

I was for a long time of opinion that the ordinary water-glass, after being completely saturated with silica, forms the best and the most suitable for all purposes. A serious inconvenience, however, showed itself in its application to stereochromy: in the last operation, that of fixing the colours, the pictures assumed a cloudy and dirty appearance in consequence of the rapid partial decomposition of the water-glass. This drawback caused Herr von Kaulbach and myself much anxiety, and suggested the idea that in this case the water-glass ought not to be completely saturated with silica. A few experiments proved this opinion to be correct; and by adding a portion of soda liquor silicum, or soluble silicate of soda, to the ordinary water-glass completely saturated with silica, I obtained a water-glass which perfectly answered the purpose. I shall call this mixture *fixing water-glass*.

In order to prepare the soluble silicate of soda (liquor silicum), three parts of pure anhydrous carbonate of soda are fused together with two parts of powdered quartz. It is kept in a rather concentrated solution, and one part by measure added to four or five parts of the concentrated potash water-glass completely saturated with silica. By this means silica and an excess of alkali are added, which are sufficient to prevent its rapid decomposition, without preceptibly altering its other properties. The water-glass, which was dull or opaque, is thereby rendered perfectly clear and a little more soluble. There is no reason why its use should be restricted to stereochromy, and why it should not be employed for various other purposes with great advantage.

Properties of Water-glass, and its deportment with other Bodies.

It is important to study thoroughly its action upon other bodies in order to prevent errors, or drawing erroneous conclusions from certain changes or phenomena.

Solid or fused water-glass, if pure, has the appearance of ordinary glass, and dissolves gradually but completely in boiling water; in the cold, however, the solution proceeds so slowly, that one feels inclined to believe that it is entirely insoluble in cold water. It becomes entirely insoluble only when a much larger quantity of silica has been added and made to combine with it, or when a portion of potash has been withdrawn; frequently, also, when other bodies, viz., earths or oxides of the metals, &c., have been mixed with it, which form double or triple silicates, such as many mineral compounds and common glass itself is composed of; for I have always noticed that silica combines more readily with two bases than with one.

Acids—carbonic acid not even excepted—decompose the solution and separate silica in a gelatinous form. Solid water glass is readily acted upon by dilute acids, and silica is separated in the form of a powder.

Salts of the alkalies, especially the alkaline carbonates or chlorides, cause viscous precipitates from a concentrated solution, and the whole solution seems to coagulate. In dilute solutions, a precipitate appears only after some time. Sal-ammoniac acts most powerfully by producing, even in a very dilute solution of the water-glass, a flaky precipitate, ammonia being simultaneously evolved. On washing this precipitate with water acidulated with nitric acid, pure silica is left on the filter.

The alkaline earths set free more or less potash on being brought into contact with a solution of water-glass, and combine with the rest of the potash to form double salts which are quite insoluble in water.

Alumina combines likewise with it, and forms a product insoluble in water; it is therefore necessary that the quartz which is used in the manufacture of water-glass should not contain any alumina. The insoluble residue which is left behind when the fused mass is dissolved in water, is probably owing to the alumina which the glass has taken up from the glass-pot.

If the water-glass is dissolved and exposed to the air in open vessels, it attracts carbonic acid and suffers decomposition, which causes it to coagulate sooner or later, and produces gradually a slimy deposit, which was found by Professor Buchner to contain potash.

Heat accelerates this decomposition. If the liquid is evaporated and the dry mass made anhydrous by further heating, it swells considerably, and will then be almost entirely decomposed. Water no longer dissolves it, and acids produce strong effervescence. By calcination it is brought back to its original state and becomes again completely soluble in water.

It is evident that constant boiling is required to obtain the soluble water-glass in a solid state by means of evaporation, in order to prevent the carbonic acid from penetrating the mass. The same precaution must be observed when fused water-glass has to be dissolved, and care must be taken always to add boiling water in order not to interrupt the ebullition, and thus to allow the access of carbonic acid.

When solid or pulverized water-glass is exposed for some time to the action of the atmosphere, it undergoes the same change as during the evaporation. It effervesces strongly on addition of acids, and is only partly soluble in water, leaving a heavy deposit. On being strongly ignited, this residue becomes again soluble. If a drop is allowed to fall on the table or on the floor, it soon loses its transparency and becomes opaque, owing to a partial decomposition. The same takes place when it is poured from a bottle and a drop runs down outside the vessel; white streaks, which are difficult to efface, make their appearance. If the liquid glass is kept in a bottle which is only half-full and badly stoppered, a white deposit or ring is formed after a short time, which adheres so firmly that it cannot be removed entirely even by acids, and a more or less heavy deposit is found on the bottom of the vessel, owing to a partial decomposition of the water-glass—a fact which I did not become aware of for some time, on account of insufficient experiments and observations. I have stated in the above-mentioned pamphlet, p. 396, "that the dried and pure water-glass undergoes no palpable change by exposure to the atmosphere, and that it attracts from it neither water nor carbonic acid. A concentrated solution is likewise not perceptibly affected by the atmosphere, although it is decomposed and converted into a stiff jelly by passing a carbonic acid through it. A dilute solution becomes turbid on exposure to the air, and is gradually entirely decomposed."

I herewith correct this error.

When concentrated water-glass is brushed upon a solid substance, such as glass, marble, or thick paper, it soon dries up and forms a shining transparent coating, which, however, does not keep long, but becomes gradually dull, opaque, and sometimes fissile and cracked, and of a somewhat pulverulent appearance. This gradual change is caused by water which the air-dried water-glass retains in rather considerable quantity (about 12 per cent.), and which it loses but slowly, whilst it contracts more and more and acquires considerable hardness.

One of the most important properties of the water-glass, and one which renders it most suitable for practical purpases, is its binding and cementing power; it may be employed for imparting solidity and greater cohesion to loose masses, for joining separate parts of bodies or small particles to form a large whole, for filling up cracks or fissures, &c., and many more applications. Its action resembles that of glue; and it might, in fact, be called a mineral glue.

Its effects are most apparent when it is applied upon solid porous bodies which absorb it, and when it is brought together with pulverulent dust or sand-like bodies, or with substances which can be crumpled up between the fingers, but which are converted into a stone-like mass, from which the water-glass can no longer be dissolved.

The intensity of the effect produced depends upon the nature of the substances with which the water-glass is brought into contact; some possess a stronger affinity than others, and consequently are more powerfully cemented than others. There is, however, this essential difference, that a few, such as magnesia and oxide of zinc, form with the water-glass a chemical compound, whilst others are only mechanically combined, owing to mere adhesive action. The former action, by which bodies are rendered hard and insoluble, will be readily understood, because an insoluble double silicate is formed by the combination with a second base. The latter is more difficult to explain, especially since the water glass shows a slightly different deportment with different bodies, and it is therefore not at all immaterial which body is chosen in order to obtain an intimate solid mass which resists the action of the water. Thus, for instance, water-glass exhibits a much greater power of adhesion for powdered marble than for powdered quartz. It has been shown, moreover, that the carbonic acid of the air promotes the consolidation of the water-glass, because it is partially decomposed when exposed to the air; however, this is not sufficient to explain the striking change which frequently becomes perceptible after the lapse of a few days. Carbonic acid, no doubt, loosens the slight tie which exists between silica and the alkali; but then the former does not remain passive, passing, according to its peculiar nature, through various states of cohesion, becoming itself active, retiring, so to speak, entirely upon itself, and cohering so intimately with the particles of the body with which it is brought into contact, and for which it possesses a strong adhesion, that the whole mass becomes petrified. If, therefore, a body does not readily cement with water-glass, it will only be necessary to add a material which combines chemically with the latter, when the desired end is sure to be obtained.

I call a mixture of pulverulent or sand-like bodies with water-glass which cements well, *water glass cement.* It may be advantageously employed in various cases instead of the common chalk-cement, as will be shown hereafter.

Water-glass imparts considerable hardness to porous bodies which absorb it, such as vessels of baked clay, plates, bricks, tiles, pottery-ware, &c.; as also to porous limestones, sandstones, and to timber.

It has been stated that water-glass does not cement all solid bodies equally well, and it will be interesting to know which bodies are more or less inclined to combine with it. I will mention only those which are available for practical purposes, and state the experiments which were made to ascertain their deportment.

a.—Carbonate of Lime.

(Chalk, Calcareous Sand, Powdered Marble.)

When chalk-powder is made into a paste with water and then well-dried and saturated with water-glass, it forms a compact mass. According to Buchner, if a piece of chalk is plunged into a moderately concentrated solution of water-glass, and left for about two days in the solution, then taken out, dried, and again put into a somewhat more dilute solution, it is found to be entirely soaked with it, and acquires on drying such an even hardness that it is very little inferior to marble, and capable of a good polish. Water does not soften it, though it assumes a slight alkaline reaction; the chalk is also increased considerably in density. Baron Liebig and Professor Buchner have confirmed this remarkable deportment of water-glass by their own experiments. Chalk, therefore, forms an excellent ingredient in order to render water-glass cohesive and insoluble in water.

The question will be asked, what produces this remarkable change in the otherwise soluble water-glass? Is it in consequence of a chemical process, *i.e.* does an interchange of the elements of carbonate of lime and water-glass take place, so that on the one hand silicate of lime, and on the other carbonate of potash, are produced?

The change of the water-glass is no doubt of such a kind, that Professor Kuhlmann may well be excused for holding the opinion that it is based upon a chemical process. This is not the case, however, as I have already stated in the pamphlet referred to, p. 400: "Several insoluble salts, such as carbonate and phosphate of lime, which do not possess the power of decomposing the water-glass, have so strong an attraction for it, that when it is evaporated with them, it loses its solubility in water, either partially or wholly."

Baron Liebig and Professor Pettenkofer have lately proved beyond all doubt, by numerous carefully conducted experiments, that no chemical interchange of elements takes place, and that not even a partial decomposition of the water-glass is perceptible.

Is then this extraordinary change merely caused by adhesion? I think that the water-glass and carbonate of lime combine directly, *i. e.*, without a mutual decomposition, forming a weak chemical compound such as is met with in the mineral known by the name of "cancrinite," which is composed of nepheline (silicate of soda and alumina) and carbonate of lime. A silicate of analogous composition has been discovered by Professor Schafhäutl in Tyrol, and called by him "didymite."

Cases are known, moreover, of undoubted adhesive action, in little or no way inferior to chemical action. I will only mention iron flint, which to all purposes is a mixture of oxide of iron and quartz; the former adhering, however, so firmly to the latter, that the strongest hydrochloric acid does not dissolve the whole of the iron from a finely powdered ferruginous quartz, even on long continued boiling, as has been shown by the experiments of Bucholz.

Powdered marble exerts the same action upon water-glass as chalk, and forms a very compact mass wich it, especially a very good cement. This cement, which may be prepared of more or less coarsely-powdered marble, may find useful application for many practical purposes, as well as the analogous mass of chalk and water-glass, since it adheres to wood as well as to stone.

b.—Dolomite.

A mineral consisting of carbonate of lime and carbonate of magnesia, which, according to experiments lately made, appears to surpass even limestone in its cementing power; and as it is considerably harder than limestone, a mixture of its powder with water-glass imparts a strong resisting powder against external, mechanical as well as chemical action. It may be classed with the best means of cementing the water-glass and to render it insoluble in water; and since it occurs frequently in nature, it may be obtained without incurring any great expense.

c.—Phosphate of Lime.

(Bone-ash.)

Phosphate of lime also gives a very compact mass with water-glass, scarcely differing in consistency from that with carbonate of lime, and, as far as has been ascertained, without undergoing any chemical action or change of its constituents. Although it is not likely that phosphate of lime will be much employed, it is interesting to know its deportment with water-glass, because it is sometimes formed by the combination of phosphoric acid and lime and brought into contact with water-glass, as will be further illustrated hereafter.

d.—Caustic Lime.

(Slaked Lime.)

Water-glass sets rapidly when caustic lime is mixed with it, and dries slowly to a rather hard mass. A chemical combination takes place between the lime and water-glass, and potash is liberated, if a sufficient quantity of water-glass be present. It is evident that water has no action upon this product. It may serve advantageously as an admixture to other masses which do not cement so well; only little can be added, however, lest the solution sets and prevents the water-glass from penetrating.

e.—Lime acted upon by the Atmosphere.

(Basic Carbonate of Lime.)

May conveniently be added to water-glass by rubbing the two substances together; it does not set rapidly, but dries up gradually to a solid mass, which is a chemical product consisting of silicate of potash and lime. Slaked lime forms a useful addition to other masses, since it will soon be converted into carbonate of lime by the action of the carbonic acid of the air, and walls coated with mortar may, after a short time, be impregnated with water-glass in order to cement them better.

f.—Pulverulent Quartz.

Quartz may be powdered as finely as possible without exhibiting any strong adhesive power or inclination to form a cement with the water-glass. If it be made into a kind of cement, and placed upon a tile moistened with water-glass, it dries up to a solid mass after a few days, and resists rain and becomes as hard as a stone on the surface. But if that surface is pierced and the inner part examined, it is found quite disintegrated and void of water-glass, the whole of which has been drawn to the surface. Repeated soaking in water-glass is necessary to render the mass homogeneous. A compact mass which leaves scarcely anything to wish for, is however obtained when a little dry-slaked lime is mixed with the powdered quartz, and then the mixture treated with water-glass.

The same takes place when water-glass is added to mortar made with quartz-sand and slaked lime, after the mass has been well dried.

g.—BURNED CLAY, AND BURNED PORCELAIN CLAY.

These two bodies do not belong to those which bind well with water-glass. We observe the same action as with powdered quartz. The water-glass only combines superficially with them, and leaves underneath a porous powder, which will only bind if repeatedly moistened with water-glass.

There exists a remarkable difference between vessels made of different kinds of clay, which become, as is usual, porous by burning, so that they absorb the water-glass readily. If, for instance, a burned plate of potter's clay which possesses no particular hardness, and can easily be broken to pieces, is saturated with moderately concentrated water-glass, and if the soaking is repeated after it has become dry, it is rendered so hard that it resists both chemical and mechanical action which is made to bear upon it. Thus Professor Kaiser prepared a plate of tile clay about half an inch thick, which was so friable that it would have fallen to pieces under the slightest pressure before being saturated with water-glass, and used it as a covering plate in an evaporating oven; and although vapours of all kinds have been passing over it for the last twelve years, they have not produced the slightest change. It is evident that potter's ware of various kinds can be rendered as durable as a plate of clay, provided they take up the water-glass readily.

h.—ZINC WHITE (OXIDE OF ZINC) AND MAGNESIA.

These two bodies combine most energetically with the water-glass, and hereby shew the same close analogy which we notice in several others of their natural as well as artificial chemical compounds.

Oxide of zinc may be ground together with water-glass without setting too rapidly. If this mass is spread rather thickly upon a slab moistened with water-glass, it contracts slowly and becomes gradually harder till it breaks up into many small pieces, which detach themselves from the support. When treated with water, these pieces retain their hardness and are no longer disintegrated; they impart a weak alkaline reaction to the water. It is evident that oxide of zinc forms an intimate chemical compound with water-glass.

If the mixture of oxide of zinc and water-glass is brushed in a thin layer upon objects, it adheres firmly to them and gives a good coating, to which a colour may be added, if desired.

This powerful action of the oxide of zinc makes it a very useful article to add to those substances which, by themselves, do not bind readily with water-glass. Even to those that do, a small admixture of the salt can be advantageous, and tends to increase the solidity, or, at all events, prevents the water-glass from making its way to the surface.

Pure magnesia, also called *Magnesia usta,* from the way it is prepared (by igniting pure carbonate of magnesia), when ground together to a paste with concentrated water-glass, sets more rapidly than a mass of oxide of zinc and water-glass, and dries up to a very hard mass, but it is liable to crack and peel off when it is put on a solid body in a layer a little thicker than a card-board. The pieces which peel off exhibit considerable hardness. Water in which they have been boiled has an alkaline reaction, but gives no cloudiness with sal-ammoniac, a proof that only a little potash, but no silica, or merely a trace, is dissolved*.

I have no doubt that magnesia as well as oxide of zinc combine chemically with water-glass, and that the former may conveniently be employed as an additional ingredient to other masses which possess less binding power.

Experiments have been made with *Magnesia alba* as an admixture to water-glass, which have proved perfectly satisfactory. This kind of carbonate of magnesia was made into a paste with concentrated water-glass, and placed upon a glass plate; it soon acquired considerable solidity, and adhered so strongly to the plate that it could only with difficulty be detached by means of a knife. A few pieces were put into water and digested for a short time; it dissolved a little carbonate of potash but no silica, which would have been indicated on the addition of sal-ammoniac. The consistency of the mass was not perceptibly altered. A part of it was powdered and boiled with water, when again traces of carbonate of potash only were found to be dissolved. Another portion was treated with dilute sulphuric acid, which gradually produced a slight effervescence, dissolving magnesia and the rest of the potash, and leaving behind silica as a gritty powder, which was perfectly and easily soluble in caustic potash.

Magnesia alba and water-glass undergo, therefore, a chemical action, by forming a little carbonate of potash, whilst silica, with a part of the potash, combines with the magnesia. Magnesia alba forms, therefore, one of the most important cementing ingredients which can be added to water-glass.

GYPSUM.

Hydrated Sulphate of Lime (CaO, SO^3+2HO).

When gypsum is ground together with water-glass it solidifies immediately, and on drying, much sulphate of potash or sulphate of soda separates, according as potash water-glass or soda water-glass has been employed in the experiment. The mass is, however, scarcely more solid than the ordinary gypsum. No doubt, a chemical action has taken place. It follows that objects made of gypsum cannot be impregnated with water-glass in order to render them more solid and capable of resisting the action of the atmosphere, because it does not penetrate into the pores. Gypsum must therefore be avoided in selecting admixtures for the water-glass; moreover, care must be taken to avoid such bodies as might form gypsum in the operation, or as might already contain gypsum.

Anhydrite, or anhydrous sulphate of lime, and, I think, strongly ignited gypsum, promise a better result; but I am unable to speak definitively on this point, as the experiments have not yet been brought to a conclusion; and I hope to be able to publish some interesting results with regard to the action of that and other substances upon water glass, viz., heavy spar, fluor-spar, oxide of iron, basic salts of iron, litharge, lead-white, &c.

The state of concentration of the water-glass is a matter of considerable importance in these experiments, and still more so in its practical application.

One part by measure of concentrated water-glass to two parts of water, may form the maximum, and one part of the same water-glass to half a part of water, sometimes even less, according to circumstances, the minimum of dilution. If it is too concentrated, it does not penetrate those bodies easily and sufficiently which it is desired to impregnate; if it is too diluted and made into a paste with pulverulent bodies, this mass may appear coherent enough when first dried, but will be found more or less friable and loose after a few days, and repeated impregnation with water-glass only can impart to it the desired solidity. Dilute water-glass interposes too much between the particles of a body, so that numerous small interstices are left, which weaken the cohesive power when the water-glass contracts on drying. All depends upon how far the saturation of such bodies with water-glass is to be carried on,—whether they are to be completely saturated with it, or only to a certain degree. In the first case we attain the greatest possible solidity; in the second we gain the advantage that colours or a coating of paint can be put on at any time and fixed by means of water-glass. It must be left to the operator to modify at will the state of concentration, and to adapt it to his purpose. I will merely state, that a body which has been completely saturated with water-glass can be again rendered porous by warming it, or, what is easier, by burning alcohol once or twice on it.

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* It is by no means remarkable that a little potash is dissolved on grinding this or a similar mass with water, since it has been found that common glass is slightly soluble in water when ground for some time in an agate mortar, and that when water is boiled for some time in a glass retort, the glass is acted upon, as was first observed by Scheele.

The pores open a little more in the course of time, especially on exposure to rain, which dissolves part of the alkali and leaves principally silica, so that at last complete petrifaction takes place, and the desired object is attained.

The question will be asked, which of the several kinds of water-glass answers best, and is the most suitable for practical purposes. Nothing definite can be stated as yet. It is possible that the potash water-glass, which sets more rapidly than soda water-glass with powdered substances with which it is mixed, may impart greater solidity to them than soda water-glass; the difference, however, cannot be considerable. On the other hand, the soda water-glass has the advantage of being more liquid, and penetrating more readily into the smallest spaces, pores and fissures, than the slightly gelatinous and difficultly soluble potash water-glass, a property which is of some importance to the sculptor and mason.* Soda does not combine so strongly with silica as potash, and has a strong inclination to efflorescence when combined with the carbonic acid of the air; and one of the advantages of soda water-glass might be due, therefore, to its parting readily with the silica, and thus accelerating the silicatisation of the mass. Further experiments, however, are required to prove its superiority.

The double water-glass seems to unite the properties of the other two, and merits preference, for the very reason that it contains two bases (potash and soda) with which silica (which prefers to form double compounds) combines more powerfully.

The fixing water-glass is used for the particular purpose already stated, but it can also be employed in many other cases, especially in painting.

The first three kinds of water-glass, when completely saturated with silica, are always more or less cloudy or opaque, owing to undissolved and very finely divided silica.

In order to deprive them of this opacity, it is sufficient to add a little liquor silicum, and to allow them to stand for about a day, stirring them occasionally. The opacity disappears completely, and the liquid becomes perfectly clear, provided it be not accidentally coloured by some other (organic) substance.

I have further to remark, that after some time a dust-like efflorescence, sometimes of slightly crystalline appearance, takes place upon bodies which have been impregnated with water-glass. This efflorescence has frightened many, and caused the water-glass to be looked upon with suspicion. But this efflorescence is far from being obnoxious; it proves rather that the process of hardening proceeds favourably, by which a little alkali is expelled, thus enabling the silica, which no doubt forms the principal binding element, to act more freely upon the bodies to which the water-glass is applied.

If the efflorescence is removed by means of a wet sponge, it will be found that the solidity of the body thus treated is not only not impaired, but even increased.

I thought at first that this efflorescence* consisted of bicarbonate of potash, because it was derived from potash water-glass, but more careful examination by M. Feichtinger, assistant in the chemical laboratory of Professor Pettenkofer, proved it to be carbonate of soda mixed with scarcely a trace of potash. All commercial potash derived from the ashes of plants—and such was the potash employed in the manufacture of this water-glass—contains more or less carbonate of soda, and thus the occurrence of carbonate of soda can be easily accounted for.

(To be continued.)

HOUSES IN RELATION TO HEALTH.

The following is an abstract of a lecture delivered at the Royal Institution on Friday, May 6, by Mr. R. Druitt:—

The speaker having alluded to the sickness, bereavement, and ruinous expense which sometimes ensue from the wrong choice of houses by private individuals, and to the disorders liable to be diffused amongst all classes, from the unhealthy dwellings of the poor, proceeded to consider the subject of houses and their influence on health, under three heads. Under the first, he treated of deficiencies of air, light, warmth, and dryness, and of the maladies of degeneration to which they give rise, of which consumption and scrofula are types; under the second, he spoke of the common typhoid fever of this country, and of choleraic disorders, and of their origin in defective house drainage; and under the third, he discussed the conditions which give intensity and power of propagation to certain diseases, such as scarlatina and diphtherite.

Amongst the details noticed under the first head, he observed that the ground on which a house is built should have the qualities of porosity and firmness; porosity is required in order that all water charged with organic debris, which happens to penetrate it, may pass onwards and undergo that rapid oxydation which is so happily effected by the London gravel. Wherever the soil is deficient in this quality, or where beds of gravel or sand come in contact with beds of clay, a thorough subsoil drainage is as essential for the health of man as it is for the growth of sweet herbage. Spots can be pointed out in which the subsoil is swampy, and where fever has prevailed in consequence. Moreover, the land on which houses are built around London is sometimes raised artificially by what is called made-earth; that is to say, on a low, wet spot, quite undrained, are heaped all sorts of rubbish, road scrapings, mud, and refuse, mixed with organic debris; and over this the houses are built. Besides, the excavation of sweet wholesome gravel, and the filling in the vacuity with rubbish, has long been prevalent at the west of London, and was much to be condemned; and an instance was quoted of a house, whose rental was £400 per annum, built over a laystall of the last century, that is, a pit where every kind of impurity was deposited, and now filled with black mould mixed with sheep bones. This earth, when dried and analyzed, yielded 10 per cent. of organic matter, and was as unwholesome to build on as an old churchyard.

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* The late sculptor Professor Maier told me, that he was enabled to employ a faulty stone in a few days as if it had contained no fissure, by dropping a few drops of soda water-glass into the crevices. He could not employ potash water-glass equally well, since it was not so liquid, and did not penetrate into the fissures.

* This efflorescence is by no means identical with that which frequently occurs on damp walls, and which acts so destructively by loosening the plastering or cement, or by detaching it all together, and which is most appropriately called "Mauerfrass." The latter is caused by salts which are contained in the material employed for building walls, most frequently by saline bodies found in the spring water which is used in preparing it. Not unfrequently saltpetre is formed simultaneously. This evil abates only when all the salts present in the mortar have effloresced. Another source of the decay of walls is to be found in the damp or saline soil upon which the walls are built, and from which the wall absorbs the salts unceasingly. A fresh coating of cement, after carefully removing the old, will improve the appearance of the wall, but only in order to furnish fresh material for slow destruction. A coating of water-glass cement, put on after carefully cleaning and impregnating the damaged wall with concentrated water-glass, can alone efficiently stop the destruction for a longer period of time.

Want of firmness might be remedied by a solid floor of concrete, after the Roman manner, which would enable houses to be built with less chance of settlements and cracks, which are causes of unhealthiness, not merely by allowing cold and damp to enter, but by permitting currents of fœtid air to come from unknown and distant sources. Thin walls, too, render a house not only extremely cold, but unwarmable in winter.

Passing over the grouping and position of houses, and the width of streets, which ought to be regulated by the height of the sun in winter, we come to the internal arrangements and air supply. The last may be provided by some special ventilating apparatus; or may be left to take care of itself; but even if left to itself, it will be prudent to see that the basement doors, and other chief apertures, are not near any source of contamination; moreover, great caution should be exercised in roofing in yards and areas with glass, as is often done, because the glass may cover over some sources of effluvia, and bring them into the house. This has been the cause of fever.

The supply of air to the apartments should be large, diffused, and not in perceptible draughts, and warmed, and should be so contrived as not to attract attention: otherwise persons who are afraid of pure air, especially servants and the poor, will speedily close up the apertures. The plan suggested by the Commissioners on Warming and Ventilation was exhibited, and described as fulfilling most of these conditions—inasmuch as the air is warmed by the heat otherwise wasted by the chimney, and is introduced in ascending currents; and care is taken that there is a channel of escape separate from the chimney, and that the upper part of the apartments should be the coolest. Any plan for bringing currents of cold air to the level of the feet, or of the bed, is to be condemned. Nothing can be a better evidence of the carelessness of our present system of air supply to houses, than the fact that much of it comes down the chimneys when there is no fire, bringing with it abundance of soot, and many, possibly unwholesome, products of imperfect combustion of organic matter.

A free supply of pure air is the *sine qua non* to persons who lead in-door lives; inasmuch as the direct influence of close bedroom air in producing scrofula and consumption had been proved incontestibly by Carmichael of Dublin; and later, by Dr. Guy. But till people have a sufficiency of food and clothing, it is a mockery to speak of pure air. Man's instinct chooses foulness before hunger, when the contact of pure air with the lungs, and of pure water with the skin, creates an appetite for food which he has no means of satisfying.

Further researches on the composition of house air are to be desired. It is evident that the amount of carbonic acid represents that of the most volatile, and probably that of the most innoxious product of the presence of living beings, and consequently the *minimum* of atmospheric impurity. The speaker had made several determinations which showed how rapidly the quantity fluctuated according to the amount of ventilation and the state of the wind. For example, in a small room in May's Buildings, Brick-street, inhabitated by two adults and three children:—

	Volumes of Carbonic Acid in 10,000 vols. of air.
April 20th. Noon; family dining	13·74
,, 21st. ,, ,, ,, ...	9·19
,, 24th. Room empty, door open ...	3·34
,, 20th. All night	15·97
,, 21st. ,, ...	15·10
,, 22nd. ,, ...	12·27
In the Infant school-room, Curzon schools, Mayfair, room crowded, with a window open at each end	9·46

In a bedroom, unoccupied, but with the doors and windows closed all day, the quantity fluctuated between 5 and 7 volumes per 10,000.

The list of maladies arising from cold, damp, airless and sunless dwellings, is a long one, and is identical with the maladies caused by hunger, depraved nutrition, solitude, and grief; moreover, the effects of dark, monotonous, and decayed dwellings upon the mind must not be overlooked, inasmuch as they produce a direct temptation to indulge in spirituous liquors.

Under the second head, the speaker alluded to the great number of modes in which a house may receive poisonous vapours from sewers. If the house drainage has not been revised during the last ten years, there may probably be every variety of imperfect and dilapidated drainage; wells that once supplied a family with water, may have beeen converted into dead wells and receptacles of filth; and even when a house possesses a perfect drainage system of its own, it may be invaded by its neighbours; or the remains of old drainage systems may have been left by the carelessness or ignorance of workmen. Every pipe, too, of whatever sort, may be a means of bringing foul air from sewers; every such apparatus should, therefore, be examined from time to time, and be regulated with philosophical precision. The possibilities were described of the entrance of air from the public sewers into houses; either from stagnation and decomposition, or through the wind which at certain times penetrates the great sewers from the river; then, whereever a sewer ends abruptly, the gases are sure to be driven out of it, through the apertures in the streets made for ventilating purposes.

The effects of back house drainage, and of sewer poison, are found in the prevalence of typhoid fever and choleraic maladies.

The great fevers at Clapham, Croydon, Westminster, and Windsor, were all of this sort, and traceable to this cause; and instances were given of illness, year after year, visiting a family, and robbing it of one or more lives; and when too late, the discovery made that an ancient, unknown, and decayed sewer ran under the premises. Many such sewers exist underground, not noticed in any map, and unknown to the present generation of officials; serving only as reservoirs of foul gases, which find vent through most unexpected channels.

It is in vain for the physician to discuss remedies whilst the patient is still breathing the vapours which caused the disease.

Lastly, the property which the diseases have of lurking in certain quarters, and then breaking out with virulence, and acquiring a self-propagating force, was ascribed to impurity in general, and to defective drainage in particular. Scarlet fever, especially, was asserted by the speaker to be caused *ab initio*, as well as to receive power of extension from this source; but the limits of the hour did not permit him to develop the evidence on this point. Thirteen contagious maladies, at the least, can be produced at will; and the speaker believed that, in time, epidemic diseases would be found subject to human control; and that the surest mode of protecting the dwellings of the rich was to cleanse and ventilate the dwellings of the poor.

Diagrams were exhibited, showing the mortality in several parts of the parish of St. George, Hanover-square, by which it appeared that, out of 20,000 inhabitants of first and second class streets there died *at home*, in the three years 1856, 1857, and 1858, 10·78 per thousand per annum; whilst, in third and fourth class streets, there died *at home*, in those three years, 20 per thousand per annum, exclusive of deaths in hospitals and workhouses. Taking the *mews* separately, there died *at home* 15·36 per thousand per annum.

The mortality and population of several streets during these years were also exhibited in a diagram, which contrasted the low mortality of purely aristocratic and first-class business streets, with that of the nest of low streets between Grosvenor-square and Oxford-street, where, owing to the crowded and unventilatable state of the houses, there is a mortality of 30 per thousand, a mortality enhanced, of course, by the deaths of the children who are born but cannot be reared in such habitations.

Home Correspondence.

EXAMINATIONS.

Sir,—Allow me to congratulate the Council of the Society of Arts on the successful termination of the Society's Examinations for the present year. The cause of "popular education" is stimulated by the peaceful rivalry which has been organised by your Society, and the competitors, whether successful or not, will have been benefited by the studies they have undergone.

I believe that the manner of conducting the Examinations is above suspicion, and that all the competitors will concur in this opinion. In considering the list of prizes however, it appears to me that the candidates do not compete on equal terms. For example, three members of the Bristol Athenæum obtained six first-class prizes and one second. I do not find fault with their success, but it seems none of them have a trade, either present or proposed, which leads me to imagine that their education has not been obtained in the Institution which they represent.

Now, the great proportion of students in our Mechanics' Institutions, Working Men's Colleges, and similar places have been at work for years before the ages of the successful members before mentioned. In fact, to give my own experience (I am only one of a class), I had been almost eight years at work before I had attained the age of Mr. Hale, and the only instruction that I previously received was a little reading, writing, and arithmetic. Amongst the candidates generally, however, may be found various staple trades, and the success of our artizans and mechanics will better test the value of the "Institutions in Union," than the victories of some other societies composed of a different class of persons. To give a few examples from the list of certificates awarded, would better show the value of the Society's Examinations than a page of written matter.

No. 132—An Edge-tool striker.—Certificate 2nd class: Latin and Roman History.
,, 377—Cordwainer.—Certificate 2nd class; Chemistry.
,, 300—Engineer.—Certificates for Arithmetic, Algebra, Statics, and Chemistry.
,, 478—Cabinet Maker.—Certificates for Electricity, Magnetism, and Chemistry.
,, 111—Plane-maker.—Certificates for French and German.
,, 128—Cutler.—Certificates for Algebra, Geometry, and Mensuration.
,, 347—Wool-sorter.—Certificates for Geography and English History.

These examples show the importance of our Institutions for adult education; and the Society's Examinations enable the various societies to measure their attainments by one common standard, which will command respect.

I hope none of the unsuccessful competitors will be discouraged; but I feel persuaded that mechanics or artizans cannot, as a rule, successfully compete with persons who have received much higher intellectual training, as well as for a much longer period.

Personally I am quite satisfied with my own success; but, hearing the subject discussed, I thought the attention of the Council ought to be called to this subject, and if the insertion of this in the Society's *Journal* should help on the cause of intellectual improvement, no one will rejoice more than

A COMPETITOR.

Sheffield, June 14, 1859.

UNIFORM MUSICAL PITCH.

Sir,—I was present at the meeting held at the Society of Arts on Friday, the 3rd inst., and listened attentively to all that was said with reference to the musical diapason. The question seems to me to be left thus, either to adopt at once a pitch because the French have made it a standard, or to take some other tone as a compromise. For many years past I have paid attention to the subject, and, to me, it seems obvious that the human voice is the natural basis upon which the matter should be determined. The only difficulty is in the application. But the following suggestion will, I think, remove the difficulty, and settle the diapason on a rational basis.

The extent of the human voice is four octaves; from the E of the first ledger line below of the base clef, to the E on the third ledger line above of the treble clef. But the D below has been reached, and also the F above. These are the extremes, making some allowance for variation of pitch beyond which the human voice cannot go. Now, the D below has been written for by Handel, the F above by Mozart. As the pitches of both these periods are known, we have these two starting points. The F above has also been sung at the Philharmonic, the pitch of which varies from the other two; and we thus have a third point, all three based upon the powers of the human voice. Now, I propose that a mean be taken of these three pitches, and whatever the number should be, that that number should be taken as the musical pitch, founded on the limit of the human voice. A selection not arbitrary, as is the case with the French pitch, or, as I conceive, the case must be if the pitch is taken in any other manner. The great advantage of this plan would be that there is a reason for it, which cannot be said of the French pitch. I do not consider that the mere fact of the French having made a selection should have any weight, for any pitch could be enforced in France, which certainly could not be done in this country; it is therefore essential that we should have a natural and rational basis, and such can alone be taken upon the human voice.

I must confess I do not understand what is meant by brilliancy as depending upon pitch. A note or a succession of notes is not of itself brilliant, the brilliancy lies wholly in the performance, not in the pitch, and the want of effect complained of, which has caused the gradual rise of modern days, is chiefly owing to a want of continuity of tone. Singers and players for the most part do not blend the tones fully in passing from one note to another, whatever may be the interval, and thus to the ear there is always a sensation as of falling in pitch, arising from a sensible break in the continuity of tone. Remove the cause, by blending the tones more fully together in the performance, and it would be at once felt that the pitch has nothing whatever to do with brilliancy of effect. Again, purity of tone is an important element as affecting the note itself and consequently the sensation of pitch. Let the note deviate in the smallest degree from purity in the intonation, and the sensation is that of flattening the pitch. Now purity of tone in the performance generally is the exception, not the rule, hence the craving of the ear for a higher pitch to act as a counter-irritant. If this view is correct, of which I have no doubt myself, and it may be easily tested, it does away with all the gratuitous suppositions advanced in the French report, and which, to say the least, are beneath notice. Apologising for obtruding myself at such length,

I am, &c.,
W. W. CAZALET.

6, Grosvenor-street, Grosvenor-square.

Sir,—Conceiving that the remarks of professional or scientific men ought to have more weight than those of amateurs, I forbore, on Friday, the 3rd inst., from taking up time which others might occupy more profitably. Now, however, I venture to offer three suggestions on the subject, which seem to me to have been overlooked in the discussion.

First, As to the strain on the voice of the modern pitch—certain songs in Mozart's "Flauto Magico," written for his sister-in-law, Aloysia Weber, were referred to in the debate aforesaid as inaccessible in the present day—being about the highest songs ever written. Now, without pleading that they were written for an exceptional voice,—accompanied by a feeble orchestra—a voice called on, however, to warble merely, and not to speak in *altissimo;*—it may be stated that they have been sung by no less than five ladies lately before the public—Mesdames Lind Goldschmidt, Gassier, Zerr, La Grange, Miolan Carvalho, while the deep bass songs in Mozart's "Serraglio" can be touched by no modern *basso*.—Can it be that certain qualities of voice die out or reappear at certain periods, in this holding analogy to physical peculiarities exhibited in health and disease, or to the extinction of certain varieties of plants and fruits?—If not, the fact, susceptible of proof by anyone familiar with musical performances, suggests the possibility that the alteration of pitch complained of has been exaggerated, and the testimony is open to cross-examination.

Secondly. It is observable that "the interest of composers," cited in paragraph 4 of the French report, signed by M. Halévy, M. Meyerbeer, Signor Rossini,—a French, a German, and an Italian composer—as a reason for lowering the pitch, has been commented on singularly by these gentlemen themselves, who, free to write in any key they pleased, have habitually written one-third higher for each voice of the quartett than the composers of the last century. The tenor part in "Guillaume Tell" rises a tone higher, and on words to be spoken (not notes warbled), than the counter tenor part in the "Messiah." (See the Swiss introduction, the Terzett, in the second act, and the final song, made memorable by the chest C of M. Duprez.) In "Le Prophète," M. Meyerbeer calls on his soprano to dwell and declaim (not to warble) on B natural and C sharp in alt. The highest note I remember in a score by Handel, is B flat in alt, in "Thais led the way" (Alexander's Feast), memorable as a rarity:—and the note is there touched, not expatiated on.

Thirdly. I submit to those requiring one pitch for all Europe, that it would be unwise to attempt this unless all European voices had one and the same quality and register. So far from this, the general scale of German tenors is higher than ours. France and Germany have no contralti; Italy and England have. Germany has no baritones; and, I believe, every musician will bear me out in asserting that the same vocal quartett, executed by four groups of voices from the four countries, in precisely the same diapason, would suggest to a nice ear a sensible difference of tune, owing to the difference of timbre. For these reasons, not to speak of the impossibility of carrying out any restrictive measures, the effect of which has yet to be tried in France, I respectfully protest against any such formal adjustment as necessary, or as conducive to a uniform excellence of musical performance, even should it be proved possible.

Yours, &c.,
HENRY F. CHORLEY.

Sir,—The French Commissioners who have presented their very able report, seem to have overlooked a primary cause of the successive elevation of the pitch, diapason, or general orchestral tone now in fashion, which is partially due to the successive improvements of wire-drawing manufactories, both in material and workmanship.

It is a well-known axiom in stringed instruments that the finest musical tone is produced when the wire or catgut is so strained as to be on the point of breaking, therefore the greater tensile strength, with a given diameter and length, any material may possess, the more powerful and musical will be the result. Compare our modern steel wire with that of a harpsichord a century old, and it will be found that it is not only far stronger size for size, but of much larger dimensions for the same note, and so far from using thinner wire than formerly, our pianoforte-makers are almost daily increasing the size, with great advantage in sonority and power. But they have also, with the same view, elevated the pitch at the same time, which has been a great mistake, because the human voice cannot be mechanically screwed up in the same manner.

Modern pianoforte wire possesses immense tensile strength in proportion to its diameter, and will probably be still more improved, but the brass strings are very weak, and often produce great inequality of tone even in our best instruments. The new alloy of aluminium and copper promises to remedy that defect, and if successful, will almost effect a revolution in stringed instruments.

In regard to instruments strung with catgut, I would suggest that experiments be made with the tail sinews of the great sperm whale of the South Seas, which I believe to be nearly three times stronger, size for size, than catgut, and being without twist, solid, and transparent, would not be liable to break on the approach of bad weather.

They may be obtained from the size of a hair to four inches in diameter, and from fifteen to twenty feet in length. Our fiddler, who had been dumb for some time, strung up and played away within twelve hours of our taking the first whale.—I am, &c.,

HENRY W. REVELEY.

Poole, June 5th.

RELATIVE VALUES OF COAL AND COKE FOR LOCOMOTIVE ENGINES.

Sir,—Would you allow me to inquire who and what is your correspondent writing upon the above subject and signing himself "I," in the last number of your *Journal?*

I think it due not only to myself, but also to the scientific public in general to ask for the information. Both should know what pretention the writer may have to discuss the matter at all. If your Society were composed entirely of gentlemen of my own profession, which unfortunately for me in this instance it is not, I would perhaps let the matter drop without even making the inquiry, as any one who has made or knows how to make a chemical analysis properly of coal and coke can see that the writer "I" is perfectly ignorant of the subject, or he would not have written such absurdities as he has, and which, if I am furnished with the information I require, I may perhaps take the trouble of pointing out.

In conclusion, I would state that I am not singular when I say that allowing the publication in your *Journal* of anonymous reviews or comments upon scientific statements given openly and by men supposed to know something of what they write, indeed whose bread has depended and does now depend upon that knowledge, is, independently of being unfair towards those men, highly derogatory to a journal such as that of the Society of Arts.

I am, &c.,
DUGALD CAMPBELL,
Analytical Chemist to the Brompton Hospital.
7, Quality-court, Chancery-lane, W.C.,
London, June 8, 1859.

Sir,—The reading of Mr. Dugald Campbell's very judicious remarks on some apparently anomalous results in the tables accompanying Mr. Fothergill's paper, makes me regret that some of my observations made on its discussion have totally escaped the reporter, the effect of which is rather to confirm the error attributed to me by Mr. Bethell, that I agreed with Mr. Pellatt and others, that the coke produced from a ton of coal would give as much heat as the original coal, whilst I admitted that hitherto, in commercial operations, such appeared to be the result, yet, when considered chemically, it ought not to be the case, my illustration being the self-evident fact that, were we to utilise the 9,000 or 10,000 cubic feet of gas and the ten gallons of tar, as well as the residual coke, it left no question but that the coal ought to yield us more "heat-giving properties" than merely those from the coke. I now repeat my expression, that I congratulated the locomotive engineer that there was so much hope in his "smoke-box," and that the French were busily employed to get it out.

Like Mr. Beattie, they are admitting atmospheric air over the fire as well as through the fire, in order to consume not only the mechanical carbon-smoke, but the carbonic oxyde, produced in abundance from all deep fires working at high intensities, especially where aqueous vapour is introduced either in the ash-pit or by damping the coke in the "tender," a practice of very questionable advantage.

We must all thank Mr. Campbell for giving us the fact as well as the authorities for such a statement, that hydrogen ought to give us $4\frac{1}{2}$ times as much heat as the same weight of carbon. This brings to my recollection "Brande's Bakerian Lecture," read in 1818, and the remarks I ventured to make upon it, in the April number of the *Philosophical Magazine* of that year, where I stated as my belief that the heat produced from "oil and coal gas" was in the exact ratio of the oxygen consumed, which statement I have oft repeated at our Civil Engineers Society. I remain, &c.,

GEO. LOWE.

Finsbury Circus, May 28, 1859.

MEETINGS FOR THE ENSUING WEEK.

Tues. ......Statistical, 8. M. de Koulomzine. 1. "On the Duration of Life among Literary Men." 2. "On the Universities of Russia."
Wed. ......Royal Soc. Literature, $4\frac{1}{2}$.
Thurs .....Philosophical Club, $5\frac{1}{2}$.
Numismatic, 7. Anniversary.
Philological, 8.
Fri. ......Royal Society Club, 6. Anniversary.
Sat.........Royal Botanic, $3\frac{3}{4}$.

PATENT LAW AMENDMENT ACT.

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APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 3rd*. 1859.]

Dated 21*st May*, 1859.

1257. W. H. Perkin, King David Fort, St. George-in-the-East, Middlesex, and M. Gray, Bonhill, Dumbartonshire—Imp. in mordanting and dyeing fabrics of cotton and other vegetable fibres.

Dated 23*rd May*, 1859.

1261. J. Knowles, Lower Broughton, near Manchester—Certain imp. in power looms for weaving.
1263. W. Crum, Thornliebank, Renfrew—Imp. in printing and dyeing textile fibres and fabrics.
1265. J. H. Mason and G. L. Baxter, Nottingham—Ornamenting lace or other twisted fabrics.
1267. J. L. Jullion, Stoneywood Works, Aberdeen, N.B.—Imp. in dressing and finishing textile fabrics.
1269. R. A. Brooman, 166, Fleet-street—Imp. in axles and in fitting wheels thereto. (A com.)
1271. W. Clark, Greenock—Imp. in machinery or apparatus for propelling and manœuvring ships, vessels, and boats.
1273. A. Barlay, Kilmarnock, Ayr, N.B.—Imp. in steam hammers.
1275. A. V. Newton, 66, Chancery-lane—An improved construction of washing machine. (A com.)

Dated 24*th May*, 1859.

1277. G. Davies, 1, Serle-street, Lincoln's-inn—Atmospheric apparatus for the submarine transport of blocks of stone, and for raising sunken vessels. (A com.)
1279. G. D. Jones, Clerkenwell—Imp. in machinery for grinding, reducing, and pulverising.
1281. W. T. Denham, Wilmington-square—Imp. in the manufacture of goffering machines.
1283. E. Page, Bedford—Imp. in horse drags or rakes.
1285. B. F. Greenough, Boston, Suffolk, Massachusetts, U.S.—An electrical conductor for submarine telegraphs, which he denominates a hpdro-electric conductor.

Dated 24*th May*, 1859.

1287. J. Harmer, St. James-street, Lower-road, Islington—Imp. in parts of dry gas meters. (Partly a com.)
1289. R. A. Glass, 115 Leadenhall-street—Imp. in submarine electric telegraph cables.
1291. A. Prince, 4, Trafalgar-square, Charing-cross—Im. in the construction of ships and vessels. (A com.)
1293. A. J. Davies, 29, George-street, Hanover-square—Imp. in apparatus for protecting persons when employed in cleaning windows, painting, or working at the exterior of houses and ships' sides, and such like operations, applicable also for purposes of military and other observation.
1295. A. V. Newton, 66, Chancery-lane—Improved machinery applicable to the manufacture of rivets, bullets, and other like articles. (A com.)
1297. C. E. Amos, the Grove, Southwark—Improved apparatus for raising vessels for repair, and for floating vessels in shallow water.

[*From Gazette, June* 10*th*, 1859.]

Dated 18*th May*, 1859.

1234. J. Brennand, Manchester—Certain imps. in the construction of carriages for the conveyance of passengers, goods, and minerals, and also in the apparatus for propelling the same.

Dated 21*st May*, 1859.

1258. T. S. Cressey, Burton-upon-Trent—Imps. in machinery for cutting staves for casks.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, June* 10*th*, 1859.]

June 10*th*.

2836. A. Barclay.
2837. C. Hodgson.
2849. A. Rollason.
2850. J. A. Carruthers and T. Blackburn.
2851. R. Whittam.
2854. J. E. Boyd.
2855. R. A. Brooman.
2864. R. A. Brooman.
2866. F. Jossa.
2867. J. Pendlebury.
2876. J. Wardill.
2880. R. Wilson, sen., and R. Wilson, jun.
2882. A. Stokes and F. J. Stokes.
2886. J. W. Friend.
2929. F. Ransome.
2937. A. Barclay.
2946. J. Railton and S. Lang.
2956. J. Smethurst.
3003. J. Lees and W. Heap.
55. G. K. Geyelin.
242. J. Kerr.
434. W. H. Horstmann.
651. G. B. Galloway.
761. G. Haseltine.
858. F. M. Crichton.
916. P. Hill.
919. J. Crossdale.

[*From Gazette, June* 14*th*, 1859.]

June 14*th*.

2874. C. F. Vasserot.
2884. J. H. Selwyn.
2885. J. W. Edge.
2888. J. J. Marçais.
2890. R. A. Brooman.
2893. W. B. Johnson.
2975. W. Taylor and W. D. Grimshaw.
3001. M. D. Wyatt.
101. R. Mushet.
121. T. Sampson.
133. W. Betts.
141. W. E. Newton.
961. J. Sidebottom.
997. L. P. Porter.
1017. J. Gillies.
1023. W. Gibson.
1047. W. Marshall.
1111. L. R. Blake.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, June* 10*th*, 1859.]

June 6*th*.

1358. W. E. Wiley.

June 7*th*.

1375. R. A. Brooman.
1381. A. V. Newton.
1387. J. Combe.

[*From Gazette, June* 14*th*, 1859.]

June 9*th*.

1373. T. Skaife.
1390. J. Eives.
1425. H. Holland.
1427. A. G. Baylis.

June 10*th*.

1398. A. V. Newton.
1399. W. Massey.

June 11*th*.

1392. P. Unwin and J. Unwin.
1400. C. J. Duméry.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4177	May 27.	Boilers for Heating Hothouses and other uses..........	Garton and Jarvis	Exeter.
4178	,, 30.	Improved Measuring Tap, for Drawing Off Stated Quantities with each motion of the handle	Charles Dutton and Joseph Jennens	West Bromwich.
4179	June 7.	Apparatus adapted to be used at Windows and such like places to facilitate cleaning, painting, and such likepurposes	William Taylor	Horsley Wylam, Newcastle-on-Tyne.

Journal of the Society of Arts.

FRIDAY, JUNE 24, 1859.

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FINANCIAL STATEMENT.

The following Statement is published in this week's *Journal*, in accordance with Sec. 42 of the Society's Bye Laws, which provides that at the Annual General Meeting "the Council shall render to the Society a full account of all their proceedings, and of the Receipts, Payments, and Expenditure during the past year; and a copy of such Statement shall be published in the *Journal* of the Society on the Friday before such General Meeting."

ANNUAL STATEMENT OF RECEIPTS, PAYMENTS, AND EXPENDITURE, FOR THE YEAR ENDING 31st MAY, 1859.

Dr.

	£ s. d.	£ s. d.	£ s. d.
To Subscriptions for the year ending 31st May, 1859 :—			
From Subscriptions			3502 0 8
Outstanding		1440 17 0	
Due on former years	563 4 0		
Estimated not recoverable	175 10 7 —	738 14 7	
available arrear of the year...		702 2 5	
Life Contributions			225 15 0
To Dividends on Stock :—			
£5136 3s. 10d. Consols		150 17 6	
£ 388 1s. 4d. New 3 Per Cent		11 8 0	
			162 5 6
To Interest on Deposit Accounts			5 9 10
Legacy by Mr. Richard Horsman Solly		100 0 0	
Less 10 Per Cent. Duty		10 0 0	
			90 0 0
To Mr. T. Twining, Junr., in aid of the Working Classes Museum		300 0 0	
Balance of Subscriptions to H.R.H., the Prince Consort's Speeches		6 1 11	
Outstanding £29 7 7			
Sale of Microscopes		3 13 6	
Do. Catalogue of the Exhibition of Inventions		10 0 0	
Do. Pamphlets		4 13 3	
Repairs to Photographic Collection		2 3 6	
Sundries		2 4 10	
			328 17 0
To Special Subscriptions held in Trust :—			
Balance of Examination Prize Fund, at London and Westminster Bank		85 15 4	
Subscriptions to the Fund, received 31st May		133 6 8	
Do. do. outstanding £20 15s.			
Marine Algæ Prize		70 0 0	
Donations :—To be awarded as a Prize for the best Writing Case for Soldiers, Sailors, Emigrants, &c.			
By Mr. John MacGregor		10 0 0	
By the Rev. F. Trench		10 0 0	
			20 0 0
			£4334 8 0

Cr.

	£ s. d.	£ s. d.
By General Establishment Expenses :—		
Rent, Rates, and Taxes	184 16 11	
Insurance, Gas, Coals, and House Charges	132 13 11	
Salaries, Wages, and Commissions	940 15 8	
Postage, Stamps, and Carriage of Parcels	110 16 11	
Stationery and Printing (not including Journal)	150 16 4	
Advertisisements	12 14 0	
		1532 13 9
By Special objects:—		
Working Classes Museum	211 7 2	
Examination Prizes (estimated at £224):		
Writing Case Prize	20 9 6	
Swiney Prize	207 11 6	
Gutta Percha Committee	12 10 11	
Sundries	0 14 0	
		452 13 1
By Ordinary Expenditure :—		
Journal, including Contract for Composition, Printing, Paper, Stamps, and Delivery £821 16 10		
Less charged to Union of Institutions £164 7 4		
	657 9 6	
Union of Institutions, including proportion of Journal, Examinations, List of Lecturers, Postage, Stationery, Printing, and other charges	614 4 11	
Exhibition of 1861	178 13 9	
Exhibition of Inventions	127 18 8	
Medals	18 9 0	
Two Conversazioni	164 14 11	
Library	57 11 1	
Artistic Copyright Committee	12 4 3	
Surgical Instrument do.	4 5 6	
Colonial do.	1 5 0	
Small Parcels Post do.	4 13 6	
Repairs and Alterations	42 16 3	
Dinner	25 9 0	
Sundries	0 13 6	
		1910 8 10
		3895 15 8
By Excess of Income over Expenditure ...		438 12 4
		£4334 8 0

BALANCE SHEET, 31st MAY, 1859.

Dr.

	£ s. d.	£ s. d.
To Sundry Creditors, viz. :—		
To Tradesmen's Bills	519 1 7	
Fees to Examiners	129 3 0	
Salaries and Commissions	24 0 8	
		672 5 3
To Working Classes Museum		213 11 2
Gutta Percha Committee		47 9 1
Writing Case Prize	20 0 0	
Marine Algæ ditto	70 0 0	
Examination Prize Fund	219 2 0	
Outstanding......£20 15s. 0d.		
To Trust Liability in respect of Government Stock (Consols) held for specific purposes, as per contra, set apart to answer :—		
Swiney Prize	1333 6 8	
Stock Trust	100 0 0	
To Government Stock New 3 per Cent., set apart to answer Fothergill Trust ...	388 1 4	
		£ 933 5 6
By Excess of Assets over Liabilities		4053 18 8
		£4987 4 2

Cr.

	£ s. d.	£ s. d.
By Cash in hand :—		
At Messrs. Coutts and Co.	211 12 11	
At Commercial Bank	241 1 3	
		452 14 2
At the London and Westminster Bank, applicable to specific purposes	309 2 0	
By Consols, £3702 17s. 2d., at 93		3143 13 0
By Subscriptions in arrear	1440 17 0	
Estimated as not recoverable on the gross amount outstanding	350 0 0	
		1090 17 0
By Government Stock held in trust applicable to specific purposes, viz. :—		
Consols	1433 6 8	
New 3 per Cents.	388 1 4	
		£4987 4 2

(Signed) J. George Appold, Sam. Redgrave, } Auditors.
P. Le Neve Foster, Secretary.

EIGHTH ANNUAL CONFERENCE.

The Institutions in Union are requested to take notice that the Eighth Annual Conference between the Representatives of the Institutions in Union and the Council, will be held on TUESDAY next, the 28th inst. at 10 o'clock in the morning. C. Wentworth Dilke, Esq., Chairman of the Council, will preside. Institutions are requested to forward, immediately, to the Secretary of the Society of Arts, the name of the representative appointed to attend the Conference.

The Chairmen of, or Representatives from, the several Local Boards of Examiners, are invited to attend the Conference.

ANNUAL DINNER.

The One hundred and fifth Anniversary Dinner of the Society will take place at St. James's Hall, Piccadilly, on TUESDAY next, the 28th inst., at half-past six for seven o'clock precisely. Members and their friends are requested to take notice that tickets (price 10s. 6d. each) may be had at the Society's House, on and after Monday, the 13th instant. The Right Hon. Lord Napier will preside.

ANNUAL GENERAL MEETING.

The one hundred and fifth Annual General Meeting, for the purpose of receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, will be held on Wednesday next, the 29th inst., at four o'clock, p.m.

The Balloting List, prepared by the Council in accordance with Sec. 101 of the Bye Laws, is issued to each Member with this week's *Journal.*

The Council hereby convene a Special Meeting of the members of this Society, for the purpose of electing gentlemen proposed as members, such meeting to take place at the close of the Annual General Meeting, to be held on Wednesday next, the 29th inst.

By order of the Council,
P. LE NEVE FOSTER,
Secretary.

22nd June, 1859.

NOTICE TO INSTITUTIONS.

The New Edition of the List of Lecturers, including information relative to Apparatus and Diagrams for Class Instruction, has been prepared, in accordance with the wish of the Institutions, as expressed at the Conference last year, and a copy has been sent to each Institution in Union, with this week's *Journal.*

OPENING OF GALLERIES OF ART IN THE EVENING.

The following letter has been addressed to the Secretary of the Trustees of the National Gallery by the Hon. Secretaries of the Yorkshire Union of Mechanics' Institutes :—

"Sir,—As representatives of nearly 100 Mechanics' Institutes comprised in the Yorkshire Union, we most respectfully appeal to the Trustees of the National Gallery, that the Turner and Vernon collections of paintings and drawings, in common with all national collections of Fine Arts, may be open for exhibition to the public of an evening as well as by daylight.

"We are induced to trouble you with this request, as the Chancellor of the Exchequer has stated in the House of Commons that the Turner and Vernon collections are to be exhibited in the new galleries connected with the museum at South Kensington, and no provision having as yet been made for artificial light, it is apprehended that the Trustees intend the Exhibition to be limited to the hours of daylight.

"It must be unnecessary to offer any argument to show the interest which is taken by the public at large, more especially the industrious classes, in the valuable collections in Museums and Galleries of Art, and the importance of allowing access to them at times convenient to those who are engaged in business throughout the day. In Yorkshire, the great success which has attended the establishment of local Schools of Art, proves abundantly the appreciation of the beautiful by even the humblest in social rank; and as those who are engaged in industrial occupations are by far the great majority of the population, this exclusion from national collections, by the exhibition being confined to hours of daylight, would be considered a great deprivation.

"As we have every reason to believe that the Trustees of the National Gallery are desirous that the valuable collections under their charge should be seen by the public as freely as possible, and as the experience already gained of evening exhibitions has proved that they are visited by large numbers of people whose orderly conduct is unquestionable, we entertain the hope that the Trustees will, in every case where practicable, allow the National Collections of the Fine Arts to be open to the public for exhibition of an evening.

"We have the honour to be, Sir, yours respectfully,
"JAMES HOLE,
"JAMES KITSON, Jun., } Hon. Secs."

MANUFACTURES, PROPERTIES, AND APPLICATION OF WATER GLASS, INCLUDING A PROCESS OF STEREOCHROMIC PAINTING.

By Dr. Johann Nep. Fuchs.

(*Translated by desire of and communicated by H.R.H. the Prince Consort, President of the Society of Arts*)

[concluded from page 526.]

SECTION II.

SPECIAL APPLICATION OF THE WATER GLASS.

The applications which water-glass has found are based upon its properties, as illustrated in Section I. By paying due regard to these properties, no serious difficulties will be met with in its special applications.

One of the most important applications of water-glass is, no doubt, that for painting, based upon its property of causing colours to adhere well, and of imparting to paintings, as well as to coats of paint, great durability and indestructibility. I call this kind of painting *Stereochromy* (from *στερεὸs* solid, firm, and *χρῶμα* colour). It designates that method of painting in which water-glass serves as the connecting medium between the colour and its substratum.

For *monumental painting* it rivals, and will eventually supersede fresco-painting. I am told that it has gained considerable ground in Prussia; that fresco-painting has in several cases been abandoned, and that mural paintings, which are in course of execution, are done by the stereochromic method. In England also this method is reported to receive great encouragement.

The so-called encaustic painting cannot be compared to it.*

At Munich, the metropolis of German art, it has not met with much favour, although first discovered at that place,—perhaps, *because* it was first discovered there.

Before I proceed to the application of water-glass in stereochromic painting, I should like to make a few more preliminary remarks.

I was first induced to investigate the soluble silicates by the many complaints which I heard in regard to fresco-paintings, especially as to their want of stability in our severe climate. I speculated as to whether colours could not be made to adhere better and more firmly upon the walls by means of water-glass than by means of lime. This led to experiments, which sometimes confirmed, sometimes negatived, the opinion I had conceived of its applicability. Many difficulties had to be overcome. Had I been able to paint myself, it would have saved me much unnecessary labour; for, owing to delays caused by submitting the various water-glasses to the judgment of others, much valuable time was lost, so that five years were spent over a great number of experiments, —expensive, though for the most part unsuccessful,— until I arrived at the desired end by the aid of Herr von Kaulbach's unceasing co-operation, and the lively interest shown by him in the new discovery.

It appears strange, indeed, that so much time and labour should have been occupied upon a discovery which in reality is so very simple, as will be seen by the following description.

It was found in the course of this investigation that stereochromy can be employed upon other substrata as well as upon walls, and that even easel pictures of moderate size can be advantageously executed; moreover, that stereochromic paintings and coatings of paint may be put upon certain grounds directly, *i. e.*, without a substratum of cement.

MURAL OR MONUMENTAL PAINTING UPON A GROUND OF MORTAR-CEMENT.

To produce a stereochromic picture of great beauty and permanence upon a wall, it is chiefly necessary to look to the *foundation* of the picture, which consists of a *lower* and an *upper* layer of mortar-cement. Errors which are committed in their preparation throw obstacles in the way of a painter and injure the beauty of the painting. The principal and most important operation in forming the ground-work, consists in imparting to the mortar-cement a thorough and stone-like solidity, and a perfect adhesion to the wall, at the same time rendering it capable of absorbing the water-glass in all its parts with equal avidity. The first layer or substratum is formed of ordinary lime-mortar; its object is to equalize the unevenness in the wall, and to cover well the stone. The sand ought to be of even grain, neither too coarse nor too fine, and it may be either calcareous or quartz-sand. It is, however, necessary to wash either kind well before using it. The lime must be properly slaked and sparingly employed, so as to render the cement—which must be made up with distilled or rain-water—rather poor than otherwise. A rich cement would not absorb the water-glass readily, and will sometimes cause it to crack.

The plaster covering thus prepared requires to be well dried, and exposed to the air for several days in order that it may absorb carbonic acid and be converted into basic carbonate of lime; for if the lime in this cement be perfectly caustic, the water-glass would subsequently be decomposed by it, and could not penetrate to the wall, —a matter of necessity if a good cementation is to be effected.

The saturation of the lime with carbonic acid may be accelerated by moistening the wall several times with a solution of carbonate of ammonia. When it is dry and the ammonia evaporated, water-glass may be employed to make it adhere to the wall. The application is repeated several times, allowing the surface to dry each time, and continued almost to the point of complete saturation. The water-glass used must be either the soda or the double water-glass, treated with as much liquor silicum as to render it perfectly clear.

Soda and double water-glass are preferable to potash water glass, because they are absorbed more easily; they ought not to be used in a concentrated state, but diluted with equal parts of water, in order to ensure their penetrating to the wall. The thickness of the plaster will be different in different places, owing to unevenness in in the wall; and since a thick layer requires more water-glass than a thin one, the latter will be saturated long before the other is, and it will be necessary to treat the thicker parts of the substratum separately with water-glass so long as it is absorbed, in order to render all parts equal.

When the lower ground has been thus prepared, the upper layer, which is to receive the picture, may be added soon after. To the careful preparation of this layer, I repeat it, the certainty of success, and the facility of the execution are mainly due.

The thickness of this upper layer is about $\frac{1}{10}$ of an inch. In its composition it does not essentially differ from the lower one, and consists of lime mortar, which ought to be made with distilled or rain water and well-washed sand (calcareous or quartz-sand) of a grain which does not exceed a certain size, and with not too much lime to prevent cracks and ensure complete absorption. It is better to run the sand through a sieve in order to obtain the right grain.

I am of opinion that artificially prepared calcareous sand, *i.e.* sand obtained by grinding marble or dolomite, is preferable to the natural sand, because the latter consists of round, smooth little grains, which do not set so well as the sharp-edged fresh grains of artificial sand. Very fine powder, on the other hand, which would set still better, is to be avoided, and should be removed by decantation or by means of a fine sieve, because it renders the mass too compact and less absorbent.

The condition of the surface of the ground for painting is chiefly dependent upon the size of the grains of sand; the coarser the grain the rougher the ground. This is to a certain degree rather advantageous than otherwise in painting, provided that water-colours adhere sufficiently until the water-glass be added. The surface ought to feel to the touch like a rasp, as Kaulbach expresses it. A difference must also be made according as the pictures are to be viewed at a great or a short distance; in the first case, the sand used may be much coarser than in the second.

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* The paintings excavated at Pompeii were formerly thought to be of an encaustic nature, and various efforts were made to imitate them, but without result, since they were, in fact, real frescoes, as was conclusively shown by Professor Schafhäutl (see 'Augsburger Allgem. Zeitung,' of January 6 and 7, 1845; 'Beilage,' p. 42, fol. 49; and Dingler's *Polytechnical Journal*, vol. xcv. p. 76.) Nevertheless endeavours have lately been made at Munich to carry out large and expensive paintings in a certain encaustic style. How great a retrograde step in monumental painting was this! The paintings brought to light at Pompeii cannot be preserved long, but gradually decay. In order to protect them, they have been impregnated with wax and brushed over with sandarac, which deprived them of much of their original beauty. Would it not have been better to impregnate them with water-glass, which, no doubt, would render them more durable without depriving them of their freshness? Carbonate of soda, with effloresces, might be wiped off with a wet sponge, after which the painting can be washed with distilled water without fear of injury.

When this coat of mortar has become dry, it is sometimes rubbed over with a sharp sandstone or iron straightedge, in order to remove the thin layer of carbonate of lime which has been formed during the process of drying, and which would prevent the water-glass from being absorbed—and also to impart the required roughness to the surface.

I cannot, however, approve of this method, and I think it far better to destroy the calcareous incrustation by means of a simple chemical reaction, viz., by dilute phosphoric acid (1 part of concentrated acid to 6 parts of water). The acid is brushed over the surface by means of a sponge or brush. Phosphate of lime is formed, which binds well with the water-glass, so that the plaster does not suffer in the least; whereas, if mechanical friction is resorted to, there is a risk of detaching small pieces, and leaving small cavities which have to be filled in again.

When the ground has been thus prepared and well dried, it is impregnated with water-glass, in order to give it sufficient consistency, and to cement it well together with the substratum. It is advantageous to employ for this purpose double water-glass clarified with liquor silicum, and diluted with its equal bulk of water. It will be found sufficient to repeat this operation twice, after allowing some time for drying. Too much water-glass would only tend to close up the pores, which would throw considerable obstacles in the way of the painter. If too much should have been used, either the whole layer of plaster must be removed, or the oversight may be made good by waiting some time, till the further contraction of the water-glass renders the ground again sufficiently porous, or by applying heat, which is best done by burning alcohol on it.

After the upper ground has been thus prepared, either by rubbing or by the action of phosphoric acid, and cemented with double water-glass to which a little liquor silicum has been added, in such a manner that the water-glass is equally spread over the whole service, exhibiting a good and even absorption everywhere, painting *may be*, but *need not be* immediately proceeded with. Delay will only increase the capacity of absorption which the ground already possesses.

The artist has to observe no further precautions, and the necessary practice will soon be acquired by painting a few easel-pieces on such ground.

Artists who should, nevertheless, doubt the efficiency of the water-glass, and who should hesitate to undertake a larger work, will meet with the best advice at the hands of Herr von Kaulbach and M. Echter, who, I am sure, will be pleased to give the desired explanations and assistance.

The colours are ground with pure water and used by the artist upon the prepared surface, taking care to moisten the wall frequently with pure water, in order to displace the air from the pores and to ensure more completely the adherence of the colours. This syringing with water must be done with moderation, and only as often as is necessary. Great care must be taken not to wet too much those parts which have been painted over, because, as M. Echter observed, the colours are liable to lose their freshness; it appears that the water washes the finest and least powerful particles of the colours up to the surface. This inconvenience is greatest in places which have to be painted over repeatedly, and have to be moistened each time. M. Echter, however, has found a remedy. He brushes away these fine particles of colour, after they have got dry and before the picture is fixed, with a very fine brush, and he thus restores the picture to its original freshness.

Nothing more remains now but to fix the colours properly, to which end the fixing water-glass is more specially employed. It suffices to dilute it with half its volume of water.

The colours which adhere but slightly do not allow of the brush being used; and it is necessary to besprinkle the painting with water-glass, in the form of a fine shower or mist, at first very carefully, so as not to displace the colours or to cause them to run one into another. Professor Schlotthauer, who has bestowed much time and labour upon stereochromic experiments, has invented a syringe for this purpose, which leaves nothing to be desired, and for which stereochromy is much indebted. The operation of alternate besprinkling and drying is continued until the colours adhere so firmly that they cannot be rubbed off with the finger. If white pocket-handkerchiefs, which are sometimes employed as tests, be smudged, it does not prove that the colours are not possessed of the desired durability, because rubbing with great force loosens grains of sand, the friction of which detaches parts of the colour that indirectly smudge the pocket-handkerchief. The same is experienced in fresco-painting.

Experiments made with regard to the durability and solidity of colours have shown, that whilst some are sufficiently fixed, others are more or less loose, and soil the finger. This refers more especially to the so-called meagre colours, like black. These require more water-glass, which is added by means of a fine brush. Baron Kaulbach told me, however, a short time ago, that this occurs now but very rarely, since it can easily be guarded against by properly mixing the colours.

This is a general outline of the method by which Director von Kaulbach, assisted by the excellent painter M. Echter, has executed four large stereochromic paintings in the new museum at Berlin; and they all, especially the last, meet with unqualified approbation among all impartial artists and lovers of the art as to the increased perfection in the technical execution, and they are generally acknowledged to be a real advance in the art of monumental painting.

Before proceeding further, I have to make a few additional remarks.

It was soon found that water-glass could not be employed in stereochromy as oil in oil-painting, *i. e.* the colours could not be ground with water-glass before applying them. A very dilute solution even rendered the brushes soon stiff, and caused the colours to harden on the pallet. It remains to be seen, however, whether water-glass is to be rejected in all cases as an admixture to colours. There is no doubt that such a mixture cannot be dispensed with when damaged pictures have to be renovated, or when pictures which have been fixed are to be painted over in some parts, in order to restore harmony between these and the other portions of the picture. I am therefore of opinion that it may render good service in painting as an addition to many colours, especially to the meagre ones. I am not speaking now of the usual potash water-glass, which is inapplicable; but of that which has had liquor silicum and water added to it, and which is used for the fixing of pictures.

When the brush begins to become somewhat stiff, it has only to be put into pure water, and after a short time it will again be found fit for use, whilst another may be employed in the mean time.

The brush must not be left exposed to the air before washing it, or else it would become quite stiff, and could no longer be softened in water.

The hardening of the colours on the pallet may easily be prevented by adding, from time to time, a drop of water by means of a dropping-glass. It is well not to put too much colour upon the pallet.

These must be considered as a few hints only upon this subject; the trial of its applicability, however, must be left entirely to the artist.

I might mention here that Kaulbach executed the first picture by means of dilute water-glass, to which I had added a little caustic potash, upon a broad tile covered with a layer of plaster prepared with powdered marble, which served him as a ground for painting upon. The trial succeeded so well, that he felt at once strongly in favour of the new method of painting. This little picture exists still, and is well preserved, although it has been much knocked about; a second and larger picture, similarly executed and well-finished, was destroyed by an accident. Soon after he expressed a wish to obtain a more tractable admixture to his colours than mere water, and I gave him a paste-like mass, such as is obtained by precipitating a dilute solution of alum with water-glass, and adding a little of the well-washed precipitate to the colours. A few trials were made, which for the most part succeeded well—some very well; but this also was not found to answer sufficiently; he thought it too tedious and inconvenient, and he convinced himself that no admixture is required when the grounds are rough, and that the colours adhere sufficiently with water alone.

Formerly, when potash water-glass was used for fixing the colours, it was often found to dry unevenly and to give a dirty appearance to the pictures, particularly when more water-glass was used than was absolutely necessary for the fixation. The "fixing water-glass" above described, has the advantage of allowing more freedom to the operator without any risk of staining the picture. An excess will only help to make the plaster-coat more durable. Should the surface be so much saturated with water-glass that an additional layer remains unabsorbed for a whole minute, it is better to blot off the excess with blotting-paper, as it might dry into greyish-white spots; but even these have been known to disappear spontaneously after a little time.

The painting is finished when the colours are fixed. It is well to wash the picture with spirits of wine after the lapse of a few days in order to remove any dirt or dust, as well as a little alkali, which is set free; and at the end of a few more days it may be washed with pure water without any risk of damage to the colours or fear of injury from exposure to the rain. Spring-water, which is apt to deposit carbonate of lime, must not be used for washing.

If a painting is to be executed on the outside of a building, care must be taken not to expose it to a heavy rain before the colours are fixed, because an hour's exposure might destroy what required weeks to execute.

The finished picture, especially when it is exposed to the open air, ought to be carefully examined, in the course of a few months or a year, to ascertain whether it has acquired any power of absorption. If so, it is evident that more fixing water-glass is required to fill up the pores caused by the gradual contraction of the original layer of water-glass. Although a second fixing operation is not absolutely necessary, it will improve the picture, for the more silica can be added to a stereochromic painting, the firmer and more durable will it become. My advice is, therefore, not to neglect the after-fixing of these paintings, especially of those on the outside of buildings, wherever it is feasible.

In the preceding lines I have spoken of the preparation which a fresh wall requires in order to render it fit for receiving a stereochromic painting, and I have now to answer the inquiry, which has frequently been addressed to me, whether old walls which are already covered with a layer of plaster can be used for stereochromic painting; to which question I can only give a conditionally affirmative reply. If the plaster has been rubbed with a rough sandstone and well smoothed, and if it then absorbs the colours well and is well cemented to the stones of the wall, thoroughly dry and free from efflorescent salts, or if, as is said in common parlance, the wall is quite sound, there is no reason why it should not be used for painting with success, after it has been duly impregnated with water-glass. This is shown by the experiments which I made with Director von Zimmermann and the late Professor Krötz.

Our wish to try the execution of a stereochromic painting on the outside of an old building, on a wall which was much exposed to the action of the atmosphere, was met half way by M. Himbsel, who desired to have two images of Saints executed at his country-house on the Lake of Starnberg, built about twenty years previously. The walls were found sound, the plaster firmly adhering to the stones (of which we convinced ourselves by striking the wall with a small hammer), and at the same time so little porous that it did not exhibit sufficient power of absorption, even after rubbing it with a very rough sandstone. We employed, therefore, phosphoric acid, diluted with ten parts of water, which was brushed twice over the wall. When dry, the wall was not very absorbent, yet sufficiently so to enable Von Zimmerman to begin his paintings without delay. The two pictures were executed without any difficulty, and satisfactorily fixed. The fixing was repeated after the lapse of a year. They are now five years old, and have remained quite intact ever since. I shall have to speak once more of these pictures.

The success which accompanied this first experiment naturally led to the idea that, perhaps, fresco-paintings could be converted into stereochromic paintings by a judicious use of water glass, and thus rendered equally solid. I leave it undecided for the present, whether this could be done successfully, as I have not had an opportunity of trying experiments, although it must appear highly desirable to discover means of protecting fresco-paintings, which are still being executed in spite of the discovery of stereochromy.

For want of experience, I can only give my opinion as to what might be the best method of procedure.

The picture would first have to be washed with rain-water, slightly acidulated with pure vinegar, by way of besprinkling, in order to remove dust and dirt, principally, however, in order to remove the thin coating of carbonate of lime which has formed upon the surface, covering the colours and preventing the absorption of the water-glass. The besprinkling is repeated with pure water in order to remove the acetate of lime which has formed, and which would interfere with the subsequent action of the water-glass. Stronger acid would discolour the ultramarine and turn the chrome-red to chrome-yellow, and therefore must be avoided. Careful manipulation is required, even with the dilute acetic acid; and slight brushing with a sponge, soaked in the dilute acid, might sometimes conveniently be substituted for the sprinkling; the acid must altogether be employed very sparingly, as the evolution of carbonic acid gas might otherwise loosen the colours and detach them from their underground. Nothing remains now to be done but to saturate the dry picture with fixing water-glass.

Our climate is, as is well known, not very favourable to fresco-painting. We have a proof of this in the deplorable state of a large and fine picture on the Isar gate at Munich, representing the Emperor Lewis, the Bavarian, after the battle of Ampfing, which was painted nearly twenty years ago, and which has already suffered so much that it is likely to be destroyed before long if it is not protected. And yet this picture is placed in a rather favourable situation, being painted on the east side of the gate, therefore not much exposed to bad weather, and sufficiently elevated to be protected from the moisture and saline matter of the soil.

And is there no guarding against the destruction of this work of art?

It is important to ascertain how far the decay has been allowed to go on,—whether it is superficial, or whether it goes to the very depth, whether fissures or cracks exist, and whether parts of the plaster have become detached. It must be left to the judgment of the renovator as to what course ought to be pursued with regard to the injured painting.

I can only say so much, that I know of no other remedy but the water-glass and the water-glass mortar; the first to fix the colours and the ground, the latter to fill up cracks and cavities, which then have to be painted over again by the artist. Although the picture may not be restored to its original perfection, it would nevertheless be protected from further decay, and saved from final destruction.

Stereochromy is but a child of late birth and has yet to struggle for its existence, and it must not be supposed that it has already reached the highest degree of perfection. Once taken up by others, it will no doubt be improved, and promises many advantages which may have been overlooked.

The chief attention must be directed to the upper layer of plaster, or the painting ground; in this errors are easily committed, and have frequently been the source of failures.

I have therefore endeavoured to obtain a still better and surer method for preparing the painting ground, and I think I have succeeded in obtaining one which answers in every respect. I propose to prepare the upper coat of nothing but *water-glass cement*, *i. e.* a mortar in which the lime is replaced by water-glass. The sand to be mixed with it may either be powdered marble or dolomite,—or quartz-sand mixed with a little dry slaked lime. [The addition of a little lime or white of zinc may also be of advantage when marble or dolomite are used, as it ensures a more perfect and powerful combination with the water-glass]. The mixture must be very intimately made. As to the proper proportions, it suffices to state that so much water glass should be added as to give to the mass the consistency of ordinary mortar.

This cement is laid on equally thick over the first plaster coat, properly smoothed and allowed to dry. It possesses many considerable advantages over the lime mortar which is *subsequently* to be impregnated with water-glass. Its preparation is simple, and every experienced mason will easily render himself master of it; mistakes can scarcely be made, as the material once decided upon remains always the same. The water-glass is equally spread through the whole mass, so as to ensure equal cementation and silicatization, which can scarcely be obtained when the water-glass is added at a later stage. During the repeated moistening of the picture no lime will be drawn to the surface and disturb the colours, because no soluble lime is left in the mass; moreover, no encrustation of carbonate of lime will ever form, and no rubbing with a stone will be required to render the surface absorbent. Lastly, the water-glass is here in immediate contact with the lower substratum, and ensures perfect adhesion to the wall, whereas the other method always leaves it uncertain whether the water-glass will penetrate the upper layer entirely and evenly.

This cement, when dry, becomes as hard as stone. At first it exhibits little or no power of absorption, which is easily accounted for, because all the pores are filled up with water-glass. It acquires, however, this property in a satisfactory degree by exposure to the air for a few days, especially when the air is warm and dry; but loses considerably in solidity by the contraction of the water-glass, and it becomes necessary to saturate it once or twice with water-glass diluted with half its volume of water, in order to impart to it the proper consistency. This must be done cautiously, so as not to stop up the pores by employing too much water-glass, which would obstruct the painting considerably. [The burning of spirits of wine on the surface would no doubt remedy the evil.]

If carbonate of soda effloresces on the surface, it is a sign that the plaster has set well. The efflorescence can easily be removed by means of a wet sponge, and the ground will then be found harder than before. Painting may now be proceeded with in the usual way.

M. Echter is at present engaged upon executing an easel-piece on a layer of water-glass cement, and the work promises well. He uses a plate of burned potter's clay, 3 feet 4 inches high and 3 feet wide and half an inch thick. After saturating the plate with water-glass, a painting ground of one-tenth of an inch in thickness, consisting of water-glass cement, was laid on and well smoothed. Painting upon this ground proceeds so well, that M. Echter assures me he could not wish for a better one.

The water-glass cement employed for this plate was made of pulverized dolomite (from which the finest powder had been removed by means of a fine sieve), and a little dry slaked lime, to which water-glass was added, so as to produce a mass of the usual plaster consistency. When dry, the plate was once more thoroughly impregnated with water-glass diluted with its own volume of water,* &c.

Hydraulic lime has also been recommended as a suitable substratum for painting, because, with a little water-glass, it forms a mass of considerable hardness and great absorbing power, in which the lime sets sooner than in the hydraulic cement. According to the experiments of M. Feichtinger, one part of solid water-glass is sufficient for 15 parts of hydraulic lime; a larger amount would be rather injurious than otherwise. But since water-glass cement responds to every application to which it can possibly be put, and since we have it in our power to prepare it most successfully, I have abstained from experimenting further upon the hydraulic lime, especially as it seems to be difficult to obtain it of uniform composition, and the result will therefore always be doubtful. In my pamphlet "On Chalk and Cements," I have already mentioned the service which water-glass is capable of rendering to hydraulic cements.†

It has already been stated that stereochromy may be applied to a variety of substrata, and that even stereochromic easel pictures can be successfully executed. When moderately burned so as to ensure good absorption, plates of clay, vessels of potter's clay, stoves of clay, &c., after being sufficiently saturated with water-glass, can be painted upon directly or indirectly. It will, however, be well to give them first a slight coating of water-glass cement, which ensures more readily a flat and equally coarse surface, suitable for painting. Easel pieces of considerable size may be painted upon plates of clay. The only limit to their size is the difficulty of managing plates of great weight. The plates should not be thicker than three-fourths of an inch, and not too much burned, so that they may absorb well. Their surface should be flat, but not smooth. Frequent saturation with double water-glass, diluted with half its volume of water, imparts to them a solidity such as strong burning could not do. Should they lose their absorbing power by the addition of too much water-glass, they have only to be warmed for some time, *e.g.*, by burning spirits of wine on them.

If it is required immediately to paint upon such a ground, it is well to add a little fixing water-glass to the colours, especially to the meagre ones. The further treatment is self-evident. Objects made of burnt clay, such as figures, ornaments, vases, goblets, &c., can likewise be painted, and would gain considerably in beauty and durability. Attention would, however, have to be paid to the quality of clay which is used for such vessels.

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* This picture has since been successfully finished, and is now in the possession of the King of Bavaria, and may be seen on a wall in the Royal Winter Garden. The artist has chosen for his subject the Madonna della Sedia, by Raphael.

† In page 49 of that pamphlet I said; "A very good method of protecting this or any other hydraulic cement from decay, and imparting to it considerable hardness, consists in the application of water-glass solution after the cement has slightly contracted. When the water-glass has been brushed over its surface, water has no longer any effect upon it. It becomes coated with a hard crust, behind which the lime and the cement quietly continue their mutual action. Small pieces put into a very dilute solution of water-glass became in two or three days so hard that they could no longer be scratched with the finger nail. The liquid, generally rendered cloudy by dissolved lime, remained perfectly clear. A method so inexpensive might, therefore, find more frequent application."

I would draw attention to an application which might be made of water-glass, viz., to impart to our stoves, which are generally made of burnt clay (Dutch-tiles), a more agreeable appearance, thus offering to art a means of embellishing our rooms, and awaking the sense for the beautiful.

In order to convince myself of its feasibility, I had a tile taken out of the stove in my laboratory, and a new one of the same clay put in, which was first sufficiently saturated with water-glass, and then painted with band-like streaks of various colours mixed with a little water-glass, and finally fixed.

After the stove had been heated several times, the colours began to loosen, and they had again to be fixed, and this fixing process had to be repeated several times.

It is evident that heat increases the contraction of the water-glass, and I should have done better by saturating the tile repeatedly with water-glass and heating it, in order to impart to it the greatest possible quantity of water-glass; and I would advise complete saturation in any fresh experiment which may be made. The colours stood very well for two winters, in spite of being daily exposed to a strong heat, and they adhered so firmly, that they could only be detached with great difficulty. The stoker, however, made an end to all further observations, by accidentally breaking the tile in pieces, upon which the colours are still preserved undimmed.

Herr von Dyk, Director of the Telegraphic Office at Munich, has shown that cast iron may successfully be painted stereochromically.

At the instance of Professor Pettenkoffer, he ordered the cast-iron stoves in his offices to be painted on the flat parts with so-called caput mortuum, and on the raised parts, such as frames and decorations, with zinc-white. The paint has stood well up to the present time. Herr von Dyk made the interesting observation, that if the colour is applied while the iron is cold, it falls off when the stove is heated, but that it adheres well if applied while the iron feels warm to the touch.

The cause of this difference lies, no doubt, in the pores of the iron being somewhat more open at a slightly raised temperature, the air being slightly rarefied or partly displaced, so that the water-glass penetrates better.

This leads me to draw particular attention to the temperature at which the fixing of the painting ground and of the stereochromic picture is performed, especially to the temperature which the water-glass itself possesses.

It is very important that the water-glass should soak in evenly and deeply, in order to ensure everywhere equal and strong cementation. For this reason, the water-glass ought to be diluted with water. Like other fluids, it is rendered much more liquid when heated—say to between 100° and 120°—and penetrates therefore more readily into any porous mass, by displacing more easily the air than it would do at the common temperature, and renders it much more suitable for fixing colours upon porous objects. This action of the heat will be the more perceptible if the objects themselves, as well as the water-glass, are slightly heated, so that with care and attention a solidity and durability may be obtained such as mosaic works only possess.

If a syringe be employed for fixing the water-glass, it is most conveniently warmed by plunging it into warm water. Mural surfaces, which have to be fixed with water-glass, are best heated by burning alcohol on them, which process, however, can only be resorted to when the colours, which adhere but loosely, have once been fixed with water-glass in the usual way.

The rooms in which the fixing process has to be carried on, ought evidently to be kept warm during this operation.

Plates of *lithographic limestone* may likewise be used as a ground for stereochromic pictures; the first trials in stereochromic painting were, in fact, confined to such stones. They require, however, to be coated with a thin layer of water-glass cement mixed with somewhat coarse sand in order to ensure the adhesion of the painting ground. When the cement is quite dry, the upper coat is put on, and painting may be proceeded with.

If the lithographic stone is treated with phosphoric acid, it takes the colours well which are mixed with water-glass; it is therefore probable that in that state they may serve for stereochromic painting without any further preparation.

There is no doubt that plates of clay-slate can be painted upon stereochromically, after having received the proper preparation. This material has the advantage over clay or limestone plates, that it is less brittle, and need not, therefore, be so thick. I have as yet made no experiment with it.* Porous sandstone and porous limestone, when well saturated with water-glass, must likewise furnish a good ground for stereochromic painting, either directly or indirectly; there is at least no reason why they should not.

No stereochromic painting has, as yet, been directly executed upon *wood.* The water-glass, mixed with colours, has, however, been successfully employed for staining wood. When wood has been properly saturated with water-glass, the water-glass cement adheres well to it, and upon a thin layer of this cement a picture might of course be executed. In many instances the method may prove very useful.

It remains doubtful at present, whether a transparent stereochromic painting can be executed upon glass. There is, however, no difficulty in painting indirectly upon glass, if ever it should be thought advantageous, since water-glass cement, upon which the painting would have to be done, binds exceedingly well with glass.

It would be very desirable to employ such a light and flexible material as *canvas* as a ground for stereochromic painting, because easel-pictures of some extent, such as altar-pieces, could then readily be painted. Several experiments have been made, which have not yet led to satisfactory results; they are, however, being continued.

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I have to make a few more remarks with regard to the colours which may be employed in stereochromy. Their number is so great that the new kind of painting is not restricted in their use.

M. Ch. Buchner, manufacturer of chemical products at Munich (Karlstrasse, No. 40), constantly keeps a complete assortment of them in store. They are:—

1. Munich-white.
2. Munich-black.
3. Munich-brown.
4. Chrome-green.
5. Cobalt-green, light and dark.
6. Chrome-red.
7. Oxide of iron, bright red, reddish brown, violet and brown.
8. Cadmium-yellow,—light and dark.
9. Chrome-yellow.
10. Ultramarine.
11. Dark ochre,—the same burnt.
12. Flesh ochre.
13. Gold ochre,—do. burnt.
14. Terra di Siena.
15. Umber,—ditto burnt.

No organic colour, such as lake, is admissible, because it will sooner or later be found to fade. Vermilion must also be rejected, because, when exposed to the light, it darkens and ultimately turns black.

The colours ought to be ground as finely as possible, because they are rendered thereby more manageable and more adhesive. Chrome-red alone forms an exception, because long-continued grinding turns it yellow.

Cobalt-blue shows a brighter blue after fixing, and light ochre becomes darker. These two colours cannot therefore be recommended for this kind of painting.

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* Paintings upon stone plates can be placed in walls in such a manner as to make them appear to form part of the wall. Once well fitted in, they are ensured against all accidents, and yet may easily be removed when a change of residence becomes necessary.

It must be remarked that the fixing process produces slight changes in *all* the colours of the painting, which appears afterwards of a somewhat darker or more sombre hue; but after some time this effect disappears again.

The colours ought to be as pure as possible; they ought especially not to contain anything which reacts upon the water-glass and produces a decomposition, or causes it to coagulate, such as gypsum or sulphuric acid, which are frequently met with in red oxide of iron (kolkothar, caput mortuum), and in yellow ochre.

I cannot close this article without saying a few words with regard to the peculiarities, the convenience and advantage which this method of painting promises in comparison with fresco-painting, and the so called *encaustic.*

Its peculiarity consists in an entirely new vehicle, differing from those employed in every other method of painting, so that stereochromy must be looked upon *as quite a new method of paitinng.* The excellence of this method depends on the substratum of the picture, which enables it to resist the action of every climate, as well as the destructive influences of smoke, acid vapours, quick changes of temperature, hail, &c., which would destroy frescoes. I have therefore called it *stereochromy.*

The new vehicle holds the painting ground and the colours, as it were, fused together, silicated or petrified, forming the material distinction of this kind of painting, and rendering it far superior to fresco-painting with its ordinary ground of lime-mortar.

The durability of fresco-paintings depends chiefly upon this mortar, even more than upon the skill of the painter, who is usually blamed when his work does not succeed, or lasts only a short time. The ruin of a fresco-painting is, in my opinion, always caused by errors committed in the preparation of the mortar; the only error almost which the painter can commit is the choice of colours which fade or become discoloured in the course of time. Cornelius, when executing the frescoes in the Glyptothek at Munich, met with several difficulties of this kind, and he was accused of not understanding fresco-painting. When I was called upon to report upon the case, I found that the plaster was rotten, and contained much sulphate of magnesia or bitter salt. I ordered this ground to be entirely removed and to be replaced by a new one, prepared with washed sand and distilled water. No further complaint was made, and the paintings have stood very well. Much depends also upon the lime used in the mortar. If slaked and kept moist for some time, it answers better than freshly slaked lime; if poor, it acts better than rich; lime containing magnesia, oxide of iron, or manganese, is better than pure lime.

Encaustic painting has two enemies; the mortar ground, and the organic materials used for painting, which are subjected to the natural laws of decay and decomposition.

In more southern countries, as in Italy, fresco-paintings withstand, no doubt, longer the ravages of time than in northern climates; they are, however, not quite exempt from destruction, as is proved by Raphael's frescoes in the Loggie of the Vatican, which are said to have suffered considerably; and it has been found necessary to take precautions to prevent the further spreading of the destructive action.

In order to test the advantages of stereochromy, proof plates were submitted to the roughest treatment; they were exposed for weeks to rain and frost; the ice which had formed upon them was allowed to thaw in a warm room, and this freezing and thawing process was repeated without in the slightest degree damaging the plates, whilst fresco-paintings treated in the same manner became quite friable and crumbled to pieces.

A small stereochromic picture was exposed, on the roof of the Royal Museum at Berlin near the chimney, to the action of wet and cold, smoke and soot, for a whole severe winter. When taken down in spring, it certainly looked as if it had been completely spoiled; but upon its being washed with spirits of wine, it was found to be as fresh as ever it had been. A small picture (two peacocks) on the west side of Herr von Kaulbach's atelier, close to the ground, has been preserved well, although the ground is thoroughly damp, and covered with shrubs in summer. It deserves to be noticed, that the damp and the efflorescence of the wall during this rather long period of time, had scarcely any damaging effect upon the picture.

A further proof of the durability of stereochromic paintings will be found in the two pictures on the country-house of M. Himbsel, on the Lake of Starnberg, to which I have already referred. They are now six years old, and are still as fresh and unchanged as if they had just come from the hand of the artist, in spite of storm and weather, which often sweeps from the west over the lake close by, and dashes the rain upon the walls with such force, that it runs down in streams, forming sometimes crusts of ice in winter.

Stereochromy offers considerable advantage to the artist; painting is quite in his power, as well as the material, whilst fresco-painting makes him a slave of the latter. He is enabled to interrupt his work and continue it again after a shorter or longer time; he can retouch his painting before fixing it, as often as he thinks it desirable. The finest colouring, the slightest touch of light and shade, the harmony of colours, and consequently the greatest perfection of a painting, are in his power.

Stereochromy possesses that advantage which fresco-painting also has over oil-painting, that the colours are not shining, and that the observer can get a full view of a picture in whatever position he may be.

I have given a description of the principles upon which stereochromy is based, and I cannot help remarking, in conclusion, that this one investigation has cost me more time and labour, together with considerable outlays and expenses, than most of my other investigations put together. Several of my friends could testify to the same many of them assisted me materially in my difficulties and I offer them my deep-felt gratitude at the conclusion of my labours. But, before all, I thank God, who graciously allowed his weak and aged servant to finish the preceding investigation of the water-glass, and its application, so far, that others may build upon the foundation I have laid.

To the Giver of all Good be thanks for all joys and sufferings experienced! May His blessing be upon the work!

"Omnia ad majorem Dei honorem et gloriam!"

Munich, Nov. 20, 1855.

[A continuation of the various other applications of the water-glass will soon follow.*]

WHAT SHOULD MECHANICAL WORKMEN BE TAUGHT?

On Saturday afternoon, the 4th of June, a lecture on this subject was delivered, at the South Kensington Museum, by Mr. J. Scott Russell, F.R.S. The following abstract of it is principally taken from the report in the *Builder*.

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* Death has put an end to the labours of the learned philosopher, and the reader will not see the promised continuation. Fuchs had a presentiment of his approaching death when he wrote the above concluding lines, and he, who never deceived others, and rarely himself, was not deceived in this presentiment. He died eighty-two years old, on the 5th of March, 1856. Two of his pupils and friends have shown what Fuchs did for his country and for science,—Prof. Dr. von Kobell, in a Commemorative Oration delivered on the 25th March, 1856, the anniversary of the foundation of the Royal Bavarian Academy of Science; and Prof. Dr. Kaiser, in a necrology, published in the March Number of the Journal of the Society of Arts and Manufacture of the kingdom of Bavaria.—Dr. M. Pettenkofer.

The lecturer commenced by observing that he had the honour of appearing before them in a somewhat unusual capacity, in consequence of a conversation which had taken place not long ago between one of that great establishment and himself on the subject of the education of the class of workmen to whom he (Mr. Russell) belonged. Mr. Cole had shown him some papers which he had prepared for the purpose of examining workmen as to the progress which they had made in the kind of education generally provided for them; and expressed to him what he (Mr. Russell) now expressed, that the education provided in this country for workmen was not that which was very directly calculated to render them good workmen. He did not mean to infer that education did not make us all the better and wiser,—at all events it put in our hands the means of acquiring knowledge, and therefore reading, writing, drawing, and accounting were good for the skilled workmen, and for every body else. It did not, however, consort with his experience, that the best reader and the best writer were always the most skilled workmen; on the contrary, the best man he ever knew could neither read, write, nor account, and yet he was a very admirable workman. As a large employer of skilled labour, he now asked whether there was any description of education which in their opinion would tend greatly to the increase of the skill, dexterity, ability, and success of the practical working mechanic. He maintained that there was, but that the mechanic did not get it. It was extremely difficult to give, but if the rising teachers of the next generation—if the institution in which they were then met—if the Government—really and earnestly cared about the mechanic, and wished to make him a good and skilled workman, and wished to keep the next generation of workmen where English workmen had ever been—namely, at the head of the workmen of Europe—he would show what it was their duty to do, and what ought to be done. If was, no doubt, difficult to accomplish; but, if they all pulled together, it could be done. It would want a good deal of money, large and wise views, and great energy and self-denial. Having said thus much of the difficulties of the undertaking, he would recommend them not to be disheartened, as, if a little seed were sown, a little agitation commenced, and a little ventilation given to the matter, the Government might be induced to do all that ought to be done. The matter, moreover, was a serious one, because the Governments of other countries were doing a great deal for the education of their practical mechanics, which we, as a nation, were not doing. He himself was obliged to get his very best draughtsmen and mechanics from foreign countries. He had men in his employment from Prussia, Germany, and Holland; and he was bound to say that, as far as preliminary education was concerned, although the workmen of foreign countries had not the skill obtained by the British workmen from practical experience, their scientific knowledge was greater, and that knowledge was telling so rapidly on the present generation of workmen, that we were now equalled (he would not say excelled) by the workmen of many countries upon whom we were inclined to look down a few years ago. He hoped they would clearly understand that he did not say anything against the education now given. On the contrary, he would say, "Continue to teach drawing, reading, writing, and accounting in the best manner you can; but if you have a class of young workmen coming forward to learn, think how you can turn the little time they can afford to give to the best advantage, so that you may raise them higher in the social scale and make them better workmen." In order to do this, it would be necessary to give them a higher class of education than they were ever taught before. They had already been taught arithmetic, and they could answer such questions as, "How many yards of ribbon at 3½d. can be bought for 30s.?" Now this was all very right and proper for shopmen and shopwomen, but would not do for mechanics. They were also taught geometry. They were taught the 16th, 17th, 18th, and 19th propositions of Euclid, but that description of knowledge was not of the slightest use to his workmen, or to anybody else. They were also taught mechanics and the law of the lever. That was right; but then mechanics and the law of the lever were not ordinarily taught in books in such a way as to be of practical use to the British workman. We did not go far enough; but the pupil teachers whom he addressed were not to blame. The persons to blame were their teachers. Two years was perhaps all the time that could be devoted to education, and six months were often devoted to as many books of Euclid, which were wasted for all practical purposes, unless, indeed, the student intended to become a professor. He would advise them to skip over the beginning, and devote the least possible time to Euclid—in fact, he would advise them to do a very heterodox thing—to cut off all the propositions but the useful ones. They might naturally exclaim: "Then, how little will be left." Very little, he admitted—but plane trigonometry would be left. Suppose, for instance, a man had but six months in which to learn. Six weeks might in that case be given to Euclid, and then trigonometry might be commenced, solid geometry might next follow, and that constituted the whole education of the workman. But that was precisely what he did not get in the present day. He would also teach within the six months conic sections, and afterwards the nature of curves, within the first, second, third, and fourth degrees. He was aware he might be met by the exclamation—"Oh! but we shall be teaching themmore than we ourselves understand:" but to this he would answer—"That is the fault of your education." Sir Isaac Newton discovered no less than 130 curves, and nine-tenths of them would be of great use to the mechanic, if he had them in two places—in his head and at his fingers'-ends. Having now got to teaching something which they did not know, and had not learned, the next thing they wanted was the assistance of the Government. Decent elementary text-books were wanted for the higher departments in mechanics, but there were many able men versed in the sciences; and what he wanted the Department of Science and Art and the Government to do was, to ask the four cleverest men in England to write, in the fewest possible English words, all that they knew (not all that they had read), or in fact so much of their brains as they carried about with them. If Government would but pay handsomely for these books, a set of treatises might be collected such as the world never saw before, and such as would be sufficient to teach any mechanic his business. They might, it was true, say, "But we do not know where to get these clever men." But he knew where they were to be got. There were three of the four present at that moment; and if the Government would but give them a thousand pounds a-piece for writing the books, he was sure they would write them. What he had said about geometry was true as to mathematics. Thirteen yards and a-half at 3½d. was not what was wanted. Of far more importance to the working man was the comprehension of the laws and relations of numbers, so as to enable the working man to think in figures about the immediate business before him. Having explained the manner in which mechanics might make reduced or enlarged models, and the relations and practical properties of numbers, the lecturer illustrated the value of a knowledge on these points by an anecdote. He remembered an instance in which a respectable working man sent in a tender for £12,500 for a very large piece of work. The tender appeared to be low, and he obtained the order, and got on some way with the work when he found he had made a trifling omission—he had forgot to multiply by *two*. His figures were all right, but in one place he forget his multiplication, and his whole calculations were wrong. He was of opinion that geometry ought to be taught by a large and comprehensive system. Professor Airy had written the best and the clearest treatise the world ever saw upon weight or gravitation. It was published in the *Penny Cyclopœdia*, and he recommended every working man to read it; for, although the subject might appear to be a dry one, he could assure them that it was most fascinating. Eilaw's Mathematical Treatise was also a succinct and admirable work, which would be found of the utmost practical utility to the working mechanic. The first and most important doctrine to remember in mathematics was, that shape is not size, and size is not shape. This might appear to be an axiom, and he thought it was as good as any in Euclid. The doctrine of similar triangles was a fundamental principle entitled to the dignity of an axiom: it was that, without regard to shape and size, any number of triangles might be made all of the same shape and not of the same size. Mr. Russell having illustrated this principle by drawings on the board, continued to say that, with respect to solid geometry, the two great duties in a workman's life were conversion of materials and adaptation to strength. A mason who used up a wrong stone, or a carpenter who selected a wrong plank, or piece of timber, showed that he was ignorant of one of the most useful portions of his art or calling. Now nothing would teach conversion of materials like solid geometry; it was in fact the daily business of the workman. It had been said that every block of marble cut from the quarry contained a beautiful statue, but the art was how to get it out of it. This was very true; for what workmen wanted to know was every shape, and how to get out another shape. The workman who took from a heap a block of stone, or a piece of timber that cost his master 50s. when a piece could be got, answering quite as well, which cost 25s., inflicted a loss upon his employer perhaps equal to a week's wages. Hence the necessity of acquiring a knowledge of solid geometry. But if there were beauty in the quantity of numbers, and in regular geometrical figures, there was infinitely more beauty in curves. It was the duty of many mechanics, especially of those engaged in ship-building, to make curved lines. To him it had always been an interesting subject to learn how curves grew. He was aware that he might be told that the higher curves were never taught, but his answer was that they might easily be taught, and that they were very easy of comprehension. In order to effect this, somebody who understood the subject would have to be prevailed upon, not to write a book, but to put down in the shortest and plainest possible language what he knew of curves. This would be a treatise which the workman could understand, and would be well worth the thousand pounds which he hoped the Government would he prevailed upon to give to one of the four clever men to write. The lecturer then explained, with the aid of the board, the various mathematical figures known as conic sections, parabola, ellipse, hyperbola, and the movement of the comets. These, he contended, might be learned so as to make the workman master of the principle within six months. The subject of the education of the workman was one which he had very much at heart. He did not know how it was to be given, but as the pupil teachers were present as an Institution which took charge of the mechanic, and a Government which was anxious for the spread of education, he would urgently beg of them to take counsel with half-a-dozen of the best mathematicians of the day, and arrange with them to write short treatises, which could be circulated at a cheap rate, and which could be taught in our elementary schools. He also thought that there ought to be a large quantity of apparatus—a sort of inventory of education—of every conceivable shape and object. In addition to these models, he would have the school-room hung round, not with pictures of animals, but with solid bodies, which could be explained and drawn. He would, in fact, impart any kind of practical rather than book knowledge. If drawings merely were used instead of models, he did not think the student could imbibe so correct a notion of the object to be produced or delineated. There was a mode of studying forms called *la théorie de développement*, but the plain English meant nothing more than making flat surfaces into round and angular forms (as models now made from sheets of paper, which was a most valuable mode of studying forms). If this description of education could be given, he would take the pupils educated in that department and give them three guineas a week. He might afterwards raise them to foremen with salaries of £500 a year, and that would be far better than remaining all their lives at the bench, earning 30s. a week. Machinery could now be obtained to do all the unintellectual drudgery of mechanism. He was not opposed to machinery, and had no apprehension that it would supersede skilled intellectual handicraft. He would employ machinery to do all the drudgery that degraded the workman into a beast of burden. He would give him higher views of mathematics; he would show him that he was an intellectual, thinking being, with a soul for high and immortal things.

Mr. Russell concluded by expressing a hope that Government would seriously undertake the education of the working man, so as to enable us to maintain our superiority among the civilised nations of the world.

Home Correspondence.

UNIFORM MUSICAL PITCH.

Sir,—In the account published in your *Journal* of the meeting held at the Society of Arts, on the subject of "Musical Pitch," an omission occurs which I shall feel obliged by your permitting me to supply, in order to show the correctness of what I stated. In speaking of the A mentioned in the French report, I said I presumed it was the A of the tuning fork, and, reckoning according to the data of our mathematicians, the number of vibrations for that note did not agree with those given by the French.

A remark made immediately upon my saying this, is the omission to which I allude. That remark was to the effect that the A of the French report was the octave to the tuning fork; viz., an octave above the second space of the treble clef. It was to this remark that I replied in the words correctly reported in your journal, viz., Taking it as that A, according to our mathematicians it ought only to give about 852 vibrations in a second.

I am, &c.,
HENRY WYLDE, Mus. Doc.

6, Burwood-place, Hyde-park, W., June 21st.

Proceedings of Institutions.

Gosport Literary Institution.—The general meeting of the members of this Institution was held on Monday, the 30th of May, Henry D. P. Cunningham, Esq., R.N., the President, in the chair. From the report of the Committee, which was read by Mr. Walter Field, the Secretary, it appeared that the number of members was 165, being an increase of 12 during the past year; that the income of the Institution had been £129 16s. 9d., and the expenditue, £122 19s. 5d.; the balance in hand, including £9 12s. 9d. brought forward, being £16 10s. 1d. It further stated that eleven lectures had been delivered during the session, the receipt on that account being £50 0s. 9d., and the expenses £42 18s. 0d., showing a profit of £7 2s. 9d. Particular allusion was made to the recent union with the Society of Arts, and the many advantages resulting therefrom pointed out. The library, it was remarked, had been increased by the purchase of some new books, and 81 members had taken out volumes, the number of issues being 737. The Report concluded by congratulating the members upon the evident progress made in every department of the Institution. Considerable discussion ensued upon the subject of Mutual Instruction

Classes and the examinations instituted by the Society of Arts, and the proceedings terminated by a vote of thanks being presented to the officers for their services to the Institution.

MEETINGS FOR THE ENSUING WEEK.

Mon. ......Geographical, 8½. 1. Mr Alfred R. Wallace, "Notes on a Voyage to New Guinea." 2. Mr. J. Macqueen, "Remarks on Portuguese Journeys across Central Africa." 3. Mr. D. O. King, "Travels in Eastern Siam and Cambodia."
Tues. ......Medical and Chirurg.
Zoological, 9.
Wed. ......Society of Arts, 4. Annual General Meeting.
Microscopical, 8.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 17th*, 1859.]

Dated 21*st February*, 1859.

474. P. Spence, Pendleton, Lancashire—Imp. in the manufacture of alum, and in the mode of, and apparatus for, condensing or destroying gases arising therefrom.

Dated 11*th March*, 1859.

626. R. Hellard, Taunton—Imp. in reaping and mowing machines.

Dated 18*th March*, 1859.

688. R. Clegg, Islington, and R. Fell, Saint Ann's-place, Limehouse, Middlesex—Improved apparatus for obtaining aerated fresh water from salt water.

Dated 22*nd March*, 1859.

730. T. Manlove, Radford-grove, and W. Hodgkinson, New Lenton, Nottinghamshire—A new method of manufacturing plain, figured, striped, and plaited textile fabrics in imitation of loom-made fabrics.

Dated 5*th April*, 1859.

852. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in open fire places. (A com.)

Dated 15*th April*, 1859.

946. G. Abeillou, Toulouse, France—An extensible arching plane.

Dated 30*th April*, 1859.

1082. W. Winstanley and J. Kelly, Liverpool—Imp. in pumps, and gearing and appliances for working the same.

Dated 3*rd May*, 1859.

1106. T. W. Miller, Portsea—Imp. in apparatus for and mode of generating steam and economising fuel.
1108. W. Sellers, Philadelphia, U.S.—Imp. in couplings for shafting. (Partly a com.)

Dated 10*th May*, 1859.

1176. W. O. Bourne, New York, U.S.—Imp. in the means of and apparatus for separating metals, ores, and other substances of different specific gravities.

Dated 12*th May*, 1859.

1194. W. Warne, J. A. Fanshawe, J. A. Jacques, and T. Galpin, Tottenham—An improved compound or preparation of materials for, and mode of, and apparatus for, covering and insulating wires or conductors used for telegraphic or electrical purposes.

Dated 18*th May*, 1859.

1230. A. R. Terry, 24, Great George-street, Westminster—Imp. in apparatus for sawing and cutting up loaf sugar.

Dated 20*th May*, 1859.

1244. G. J. Parfitt, Bath—Imp. in gas burners.

Dated 21*st May*, 1859.

1252. A. L. Taylor, 16, Ludgate-hill—An improved form of harmonican pianoforte.

Dated 23*rd May*, 1859.

1260. J. H. Brierley, Halifax, and G. Old, Temple-street, Birmingham—A brace buckle.
1262. R. V. Leach, Briton Ferry, Glamorgan, and T. W. Willett, Pont-Neath-Vaughan, Brecon—Imp. in the manufacture of tin plates and terne or leaded plates, and in the apparatus connected therewith.
1264. G. Burnell, East Hoathly, Sussex—An improved preparation or medicine for the cure of ague.
1266. H. A. Cooke, Chancery-lane—Imp. in omnibuses.
1268. C. P. Moody, Corton Denham, Somersetshire—Imp. in machinery for the manufacture of matting or fabric from straw and other vegetable fibres, and rods or bars of wood and metal.
1270. F. J. Bramwell, Great George-street, Westminster—Imp. in apparatus for raising ships and vessels out of the water. (Partly a com.)
1272. N. S. Dodge, 44, St. Paul's Churchyard—Imp. in treating waste vulcanized india rubber. (A com.)
1274. N. S. Dodge, St. Paul's Churchyard—Imp. in finishing, colouring, and varnishing india rubber goods, and similar manufactures. (A com.)

Dated 24*th May*, 1859.

1276. J. Stansfield, Batley, Yorkshire—Imp. in the permanent way of railways.
1278. J. C. Fisher, 51, Catherine-street, Glasgow—Imp. in preparing paints and varnishes.
1280. J. Gibbs, Brentford, Middlesex—A method of treating coal, shale, lignites, and peat, in order to manufacture manure.
1282. G. Hadfield, Carlisle—An improved arrangement of heating and evaporating apparatus.
1284. A. J. Sax, Paris—Imp. in wind musical instruments.

Dated 25*th May*, 1859.

1288. D. S. Price, 7, Green-street, Grosvenor square, Middlesex—Imp. in the production of colours for dyeing and printing.
1290. E. Maw, Doncaster Ironworks, Yorkshire—Imp. in the construction of metallic bedsteads and other furniture.
1292. A. Prince, 4, Trafalgar-square, Charing cross—Imp. in screw propellors. (A com.)
1291. J. Mallet, Barnstaple, Devon—An improved regulator for watches, portable clocks, and timepieces.
1296. J. Howard, Bedford—An improved construction of horse-rake.

Dated 26*th May*, 1859.

1298. J. Webster, Birmingham—An imp. or imps. in pressure and vacuum guages.
1299. J. Reynolds, 11, Carthusian street, Charterhouse-square—Imp. in propelling vessels.
1310. H. W. Patrick, 4, Mill-hill-terrace, Acton—A new substance or material to be used in lieu of ivory and other like substances.
1301. C. Dorn, Birmingham—Imp. in kilns for baking or burning China earthenware and bricks, and for other like purposes.
1302. J. Young, Wolverhampton—Imp. in locks, and in the manufacture of knobs for locks and latches, and also in apparatus for preventing draughts and keeping out wet from doors and windows.
1303. P. Effertz, Manchester—Certain imp in machinery or apparatus for cutting paper, pasteboard, cardboard, and also for cutting or slicing wood into thin scaleboard or veneers, or for similarly cutting other articles.
1304. G. F. Chantrell, Liverpool—Imp. in the construction of charcoal kilns, and in the manufacture of coolers for charcoal kilns.
1305. W. H. Nevill, Llanelly, Carmarthenshire—Imp. in the manufacture of steel and wrought iron.
1306. J. Draper, 5, Little Tower-street—Imp. in applying indices to account and other books.
1307. M. Michaelis, Manchester, and R. Kershaw, Heywood—Imp. in the manufacture of velvets and other piled fabrics.
1308. J. C. Bent, Birmingham—Imp. in gas meters.
1309. W. Wright, Deptford—Imp. in fastening shirts, collars, and other articles of wearing apparel.

Dated 27*th May*, 1859.

1311. W. Weild, Manchester—Imp. in looms for weaving pile fabrics.
1312. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved mode of advertising. (A com.)
1313 P. Aitchison and T. Binks, Sheffield—Imp. in self-acting and other water closets, and in flushing apparatus connected therewith.
1314. L. Farrenc and B. Subra, Paris—Imp. in gas lighting by means of direct carburators.
1315. H. N. Nissen, Mark-lane—An imp. in book indexes.
1316. G. Hadfield, Carlisle—Imp. in the mode of and apparatus for forming casks or barrels.

Dated 28*th May*, 1859.

1317. B. Samuelson, Banbury—Imp. in machines for cutting roots and other vegetables.
1318. T. Wilson, Birmingham—Imp. in breech-loading fire-arms and ordnance.
1319. W. Crum, Thornliebank, Renfrew—Imp. in printing and dyeing textile fibres and fabrics.
1320. W. A. Graveley, Upper East Smithfield—Imp. in apparatuses for purifying and aerating sea water, parts of which may be employed for cooking and baking purposes.
1321. R. A. Brooman, 166, Fleet-street—Imp. in machinery for cleaning, grinding, and bolting corn and other grain. (A com.)
1322 J. Oldbury, Summer row, Handsworth, Staffordshire—Imp. in breech-loading fire-arms, applicable to pistols, muskets, carbines, and birding or other guns.
1323. J. Bapty, Leeds—An improved mode of, and apparatus for, manufacturing felted cloth.

Dated 30*th May*, 1859.

1321. M. Davis, 5, Lyon's-inn, Strand—Imp. in the construction of wheels, axles, and boxes for carriages.
1325. A. Smith, 69, Princes-street, Leicester-square—Imp. in machinery for making lines, ropes, and cables, for telegraphic and other purposes.
1326. W. Grimshaw, Bowdon, Chester—Certain imp. in machinery for compressing bricks, tiles, artificial fuel, and other similar articles.
1327. E. Breffit, 61, King William-street—Imp. in machinery or apparatus for the manufacture of hollow corks.
1328. J. Bruce, Tiddington, near Stratford-on-Avon, Warwickshire—An imp. in agricultural drills.
1329. W. Gossage, Widnes, Lancashire—Imp. in the manufacture of iron and steel.

1330. J. Fry, Wrotham, Sevenoaks, Kent—An imp. in mills for grinding.
1331. O. Maggs, Bourton, Dorsetshire—Imp. in harrows.
1332. W. Green, Victoria Works, Dod-street, Limehouse—Imp. in washing or purifying and treating sugar.
1333. I. Blackburn and R. Blackburn, Long Eaton, Derbyshire—Imp. in locomotive and traction engines, and in implements connected therewith for cultivating the soil.
1334. J. L. Norton, Belle Sauvage-yard, Ludgate-hill—Imp. in machines for stretching and drying fabrics, and in drying wool and other fibres.
1335. A. Micklethwaite, J. Peace, and S. J. Hobson, Sheffield—Imp. in the coating and covering of metallic springs, steel, iron, and other metal bands for the use of any kind of machinery, driving bands, or straps, ribs suitable for umbrellas and parasols, staybusks, and ribs for stays, hats, bonnets, reeds, and crinoline, and articles of dress, and other useful purposes.
1336. E. Leeson, 13, Traffic-street, Derby—Imp. in machinery for the manufacture of ornamental chenille fringes and braids or other fabrics.
1337. W. Clark, 53, Chancery-lane—Certain improved means of reefing and shortening sail in ships and other vessels. (A com.)
1338. W. Clark, 53, Chancery lane—A new manufacture of leaven. (A com.)

Dated 31*st May*, 1859.

1340. J. S. Cockings, Ann-street, Birmingham—Certain imp. in the construction of self-adjusting cases for holding and carrying cartridges of various sizes or guages, parts of which imps. are also applicable to cartridge-carriers now in use.
1341. S. Carr and G. Butterworth, Leeds—Imp. in the manufacture of felted cloth, and in the machinery or apparatus employed in such manufacture.
1342. E. A. Wood, Victoria-terrace, Notting-hill, and D. Rogers, Bromley, Middlesex—Improved apparatus for raising and lowering boats.
1343. J. Wansbrough, Bridge-street, Southwark—Imp. in the construction of stereoscopes. (A com.)
1344. G. H. Smith, Manchester—Imp. in sewing machines.
1345. P. Gambardella, 123, Chancery-lane—Imp. in obtaining motive power, and in machinery or apparatus connected therewith.
1346. J. J. Lundy, Manchester—Imp. in cartridges and gun-wads, for facilitating the loading and lubricating of fire-arms.
1317. A. Suter, 65, Fenchurch-street—A furniture castor, to be used upon the feet of tables, seats, and all descriptions of furniture or other things.
1348. F. Roberts, Maiden Newton, and A. Roberts, Frome, Vanchurch, Dorsetshire—Imp. in apparatus employed for ploughing, tilling, or cultivating land, when steam power is employed.

Dated 1*st June*, 1859.

1349. J. F. Miquel, Paris—Imp. in trusses.

Dated 2*nd June*, 1859.

1351. F. W. Saltonstall, Northumberland street, Strand, and A. Bush, Hanover-cottage, Park-road, St. John's-wood—An improved machine or apparatus for dredging and excavating
1352. M. H. Chapin, 4, Gresham-street—Imp. in galloons, tapes, or ribbons, for supporting steel and other hoops used for distending ladies' dresses.
1353. R. K. Whitehead, Elton, near Bury, Lancashire—Imp. in apparatus to be used in bleaching, dyeing, and extracting the colouring matter from dye materials.
1354. S. Wood and J. Wood, Manchester, and P. Billington, Rusholme, near Manchester—Certain imp. in and applicable to machines for embroidering.
1355. A. Smith and W. Smith, Glassow—Imp. in machinery for curing sugar, and for separating solid and liquid substances by centrifugal force.
1356. S. Bury, Manchester—Certain imp. in machinery or apparatus for embossing and finishing textile fabrics or other like surfaces.
1357. S. Bury, Manchester—Certain imp. in machinery or apparatus for embossing and finishing textile fabrics or other like surfaces.
1358. W. H. Parkes and W. Bagnall, Birmingham—A new or improved ventilator for hats and other head coverings, and also for carriages.
1359. T. Whitby, Millbank-street, and W. Dempsey, Great George-street, Westminster—Imp. in and applicable to ordnance and firearms, and in the projectiles to be used therewith.
1360. J. B. Pascal, Paris—Imp. in hot-air engines.

Dated 3*rd June*, 1859.

1361. J. Wilson, St. Helens, Lancashire—Imp. in the manufacture of carbonate of soda.
1362. J. Edwards, 77, Aldermanbury—Imp. in the manufactures of anchors.
1363. R. W. Sievier, Upper Holloway—Imp. in smelting and purifying of iron and other ores.
1364. J. Onions, Darlaston, Staffordshire—A new or improved steam boiler.
1365. R. Mushet, Coleford, Gloucestershire—An imp. or imps. in the manufacture of iron and steel.
1366. H. N. Penrice, Witton-house, near Norwich—Imp. in machinery for propelling vessels.
1367. J. Kyle, Liverpool—Imp. in points for railways and chairs for the same.
1368. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in reducing solid substances to powder, and in the machinery or apparatus employed therein. (A com.)
1369. J. J. Baranowski, Paris—Imp. in railway signal apparatuses.
1370. A. R. Arrott, St. Helen's, Lancashire—Imp. in the manufacture of soda.
1371. Rev. J. Burrow, Ashford Parsonage, Bakewell, Derbyshire, and W. N. Wilson, 144, High Holborn—An improved floor scrubber and sweeper for carpets, lawns, and other such like useful purposes.
1372. A. V. Newton, 66, Chancery-lane—An imp. in balancing millstones. (A com.)

Dated 4*th June*, 1859.

1373. H. Crossley, Nailsworth, near Manchester—Imp. in Jacquard machines.
1374. R. Chrimes, Rotherham, Yorkshire—Imp. in apparatus for supplying water to, and discharging the contents from, urinals, wash-hand basins, and other similar articles.
1375. E. Gill, the Elms, St. Ann's-road, Wandsworth-common—Imp. in producing spirit from rice, maize, and other descriptions of grain.
1376. J. Nuttall, Old Accrington, G. Riding, Clayton-le-Moors, and W. Coulthurst, Old Accrington, Lancashire—An improved size powder, to be used in sizing cotton, linen, or other warps for weaving.
1377. G. Davies, 1, Serle-street, Lincoln's-inn—An imp in wearing apparel. (A com.)
1378. J. Wood and W. Wood, Nottingham—A peculiar mode or method of dyeing lace or other fabrics, and making the same into bonnet and cap fronts, or other articles.
1379. C. James, Mountain Ash, Aberdare, Glamorganshire—An imp. in the manufacture of railway chairs.

Dated 6*th June*, 1859.

1382. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in paddle-wheels and screw propellers for steam-vessels. (A com.)
1384. W. Green, 2, Victoria-street, London—Imp. in mowing machines.

Dated 7*th June*, 1859.

1386. K. H. Cornish, 5, Essex-court, Middle Temple—Imp. in bedsteads, sofas, couches, and chairs, applicable to other seats or reclining surfaces.
1388. W. B. Nation, Union row, Union-bridge, Rotherhithe—Imp. in the manufacture of superphosphate of lime.
1390. R. Barclay, Bucklersbury—Imp. in the manufacture of paper from which writing or other inks cannot be expunged or extracted without detection.
1392. R. R. Fairgrieve, Boston, U.S., and S. Bathgate, Selkirk, N.B.—Imp. in machinery or apparatus for winding yarns or thread.

Dated 8*th June*, 1859.

1394. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth, Durham—Imp. in looms for weaving, some of which improvements are applicable to other purposes.
1396. J. B. Howell, Sheffield, J. Hick and W. Hargreaves, Great Bolton, Lancashire—Imp. in apparatus for applying heat to steam or other boilers or vessels, and for facilitating the combustion of gases and smoke.
1398. J. B. Molozay, 68, Rue d'Angouleme du Temple, Paris—New means of manufacturing velvet.
1400. A. V. Newton, 66, Chancery-lane—Imp. in gas meters. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, June* 17*th*, 1859.]

June 17*th.*
2900. J. Mackenzie.
2902. J. Taylor.
2908. S. Hunter.
2910. J. Ronald.
2914. W. E. Dando.
2924. M. Kenney.
2933. J. Ronald.
2958. W. A. Gilbee.
2861. C. M. A. Marion.
2997. J. W. Duncan.
40. R. Rumney and W. S. Macdonald.
30. J. Furnival, T. Furnival, J. Derbyshire, and F. J. Emery.
82. B. Bobbin.
100. R. Mushet.
132. R. Mushet.
134. R. Mushet.
234. W. E. Newton.
3.0. H. C. Jennings.
860. I. Adams.
988. A. W. Williamson.
1110. J. Morse.

[*From Gazette, June* 21*st*, 1859.]

June 21*st.*
2917. W. S. Yates.
292[illegible]. R. Clegg, F. Angerstein, and G. Ferry.
2926. E. T. Dunn.
2930. A. Prince.
2942. J. W. Child.
2954. J. Radley,
2966. J. Sinclair.
12. Pierre Emmanuel Guerinot.
37. F. Clark.
39. J. Howard.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, June* 17*th*, 1859.]

June 13*th.*
1418. E. Guerin.
June 14*th.*
1336. W. Smith.
June 15*th.*
1453, J. Bullough.

[*From Gazette, June* 21*st*, 1859.]

June 16*th.*
1436. W. H. Tucker.
1437. M. A. Muir and J. M'Ilwham.
1438. C. Clifford.
1441. G. Tillett.
1473. H. H. Vivian, B. G. Herrmann, and W. Morgan.
1475. I. Atkin and M. Miller.
June 17*th.*
1479. J. Saxby.
June 18*th.*
1934. P. Noyer.

Journal of the Society of Arts.

FRIDAY, JULY 1, 1859.

EIGHTH ANNUAL CONFERENCE.

The Eighth Annual Conference between representatives from the Institutions in Union and the Council of the Society, was held at the Society's House, on Tuesday, the 28th June, at 10 o'clock a.m. Mr. C. Wentworth Dilke, Chairman of Council, presided.

The following is a list of the Institutions and Local Boards of Examiners represented at the Conference, with the names of their respective representatives:—

Aberdeen, Mechanics' Institution	Mr. Alexander Bain.
Allenheads Library & News Rooms	Mr. Thos. Sopwith, jun.
Ashford, S.E.R. Mechanics' Institute and Local Board	Rev. J. P. Alcock.
Barnet Institute	Mr. Stephen Baldock.
Basingstoke, Mechanics' Institution	Mr. G. Sclater Booth, M.P., and Mr. Wyndham S. Portal
Battle, Mechanics' Institution	Mr. Horace Martin.
Belfast, People's Reading Rooms	Sir H. M'Calmont Cairns, M.P,
Bexley Heath, Useful Knowledge Society	Mr. Flaxman Spurrell
Birmingham, Midland Institute	Mr. Arthur Ryland. Mr. W. Mathews, jun., M.A.
,, Messrs. Chance's Library and Reading Room	Mr. F. Talbot.
Blackburn, Literary, Scientific, and Mechanics' Institution and Local Board	Mr. Robt. C. Radcliffe.
Brighton, Mechanics' Institution	Rev. A. J. Ross.
,, Sussex Local Board	Mr. Barclay Phillips.
Bristol Athenæum	Rev. Canon Girdlestone.
Bury St. Edmund's, Athenæum	Rev. J. B. P. Dennis.
Chelmsford, Literary and Scientific Institution	Mr. W. W. Duffield.
Chichester Literary Society and Mechanics' Institute	Mr. H. W. Freeland, M.P.
Darlington Mechanics' Institute	Mr. F. Mewburn, jun.
Devizes Literary and Scientific Institution	Mr. S. Watson Taylor.
Glasgow, Institution and Local Board	Mr. Thomas Morrison, A.M.
Gosport and Alverstoke, Literary and Scientific Institution	Mr. Walter O. Field.
Halifax Mechanics' Institute	Mr. Frank Crossley, M.P.
,, Working Man's College	Mr. George Gibb.
Hartlepool, Literary and Mechanics' Institute	Mr. Christopher Salmon.
Hastings, Mechanics' Institution	Mr. John Banks.
Hereford Permanent Library	Mr. William Aston.
Highgate, Literary Institution	Mr. James Yates and Mr. W. P. Bodkin.
Huntingdon, Literary Institution	Mr. Robert Honey.
Ipswich, Mechanics' Institution	Mr. Thomas S. Gowing.
Kingston-on-Thames, Mechanics' Institution	Mr. John M. Clabon.
Leeds, Mechanics' Institution	Mr. James Hole.
Leeds, Young Men's Christian Institution	Rev. Clement Bailhache.
Leeds, Yorkshire Union	Mr. Barnett Blake.
Lewes, Mechanics' Institution	Mr. Henry Brown.
Liverpool, Collegiate Institution	Rev. J. S. Howson.
,, Institute	Mr. Astrup Cariss.
Lockwood, Mechanics' Institute	Mr. John Symonds.
London, Chelsea Athenæum	Mr. Robert Hunt, F.R.S.
,, Clerkenwell Working Men's Institution	Mr. Charles Binyon.
,, Crosby Hall Evening Classes for Young Men Local Board	Rev. W. Lusignan.
,, Mechanics' Institution	Mr. S. Vallentine & Mr. T. J. Pearsall.
,, ,, Local Board	Mr. T. A. Reed.
,, Marylebone Literary and Scientific Institution	Mr. Christopher Eales.
,, Royal Polytechnic Evening Classes	Rev. J. B. Owen and Mr. J. C. Buckmaster
,, St. Bartholomew's Literary Institute	Rev. John Green, M.A.
,, St. Mary's, Islington, Working Men's Institute	Mr. John Lee & Mr. D. F. Wilson, M.A.
,, Tailors' Labour Agency Literary Institute	Mr. Robert Edwards.
,, Walworth Literary and Scientific Institution	Mr. J. S. Noldwritt.
Morpeth, Mechanics' Institution	Mr. Soulsby.
Northallerton, Institute	Mr. W. B. Wrightson, M.P.
Paisley, Artizan's Institution and Local Board	Mr. Robert Wilson.
Peterborough, Mechanics' Institute	Mr. J. Whitwell.
Portsmouth and Portsea, Literary and Philosophical Society	Mr. W. Hamilton, R.N.
Richmond, Parochial Literary and Local Board	Dr. Ellis. Rev. W. Bashall.
Sheffield, People's College	Mr. T. Rowbotham.
Stratford, Eastern Counties Railway and Stratford Mechanics' Institution	Mr. T. G. Tonge.
Wallingford, Mechanics' Institution	Mr. Robert Payne.
Warminster, Athenæum	Mr. W. H. Carson & Rev. H. May Gunn.
Waterford, Mechanics' Scientific Institution	Mr. John A. Blake, M.P.
Whitby, Institute	Mr. Edwin Cockburn.
Wigan, Mechanics' Institution	Mr. Henry Woods, M.P.
Wilton, Literary Institute	Mr. J. E. Nightingale.
Winchester, Mechanics' Institution	Mr. Hugh Wyeth.

The Secretary read the following

REPORT

TO THE COUNCIL OF THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

Gentlemen,—In my report which was laid before the Conference last year, the results of the Examinations then held were detailed, with full explanations of the system which the Council had found it necessary to adopt, in order that all the Institutions in the Union throughout the whole of the United Kingdom might on equal terms enjoy the important benefit of Examination. It is, therefore, unnecessary on the present occasion to enter into any further explanation of that which is, no doubt, familiar to all present at the Conference. Before, however, I give an account of the business of the year which has just closed, I must record, in connection with last year's Examination, that four of the successful Candidates have since obtained Government appointments on nominations which had been kindly placed at the disposal of the Council of the Society of Arts by Lord Derby. Mr. Thomas Ross Howard and Mr. George Edward Skinner obtained the first and third places respectively in a competition for Clerkships in the Customs; and Mr. George Harrison and Mr. George Best were placed first and second respectively in a similar competition for Supernumerary Surveyorships of Taxes.

In making these nominations, the Council were necessarily restricted in the selection by the Government regulations as to the age of the Candidates, and the branches of knowledge with which they were required to be acquainted.

The system of Examinations, carried out last year, having been found to work perfectly well, has been again adopted this year; and the Examinations, conducted upon it with such slight modifications in some of the working details as experience had shown to be necessary, have just been completed.

In the Society's *Journal* for the 10th instant, the results, so far as they relate to the award of Certificates and Prizes to the Candidates, have been published, and a copy has been sent to each Candidate.

In the *Journal* for the 17th instant, the awards of prizes given by the Council to Local Boards and to Institutions were announced. It will be remembered that one of the conditions on which an Institution was to become entitled to a prize, was not merely that its Candidate should have obtained the first prize in any subject, but that the Institution should have afforded to the Candidate special instruction in that subject. Hence the difference in the number of the Candidates obtaining first prizes and of the Institutions getting prizes in respect of these Candidates. It is to be hoped that Institutions may be enabled in future years to give more systematic class instruction to their members. Had all the Candidates who received first-class prizes received at their Institutions systematic instruction in their several subjects, the Institutions would have carried off sixteen prizes (=£80) in lieu of only seven prizes (=£35).

There has been this year a large increase in the number of Candidates examined at the final examinations, viz., 480, as compared with 288 last year, *i.e.* an increase of exactly two-thirds on the last year; and a larger number of Local Boards in operation, namely, 54 in the place of 40 last year. The total number of Boards which have been formed since they were proposed by the Council in the autumn of 1857 is 80, of which 19 were newly formed this year. Scotland and Ireland, for the first time, have now taken part in these Examinations. Four Boards were formed in Scotland and two in Ireland, and Candidates from each have attended the Final Examinations.

The number of Candidates who attended the previous Examinations this year has been 641; of these, 544 were returned by the Local Boards as qualified for the Final Examination; but of them only 480 attended it. 368 Candidates obtained Certificates, whilst 112 were unsuccessful. The number of worked papers which came under the consideration of the Examiners was 766, and on these were awarded 540 Certificates, divided thus:—78 first class, 154 second class, and 308 third class. In comparing the numbers attending the Examinations this year with those of last year, it will be seen that, while there is a large increase, viz., 480, as compared with 288 in the number actually attending the Final Examinations, yet, looking at the table appended to this report, the number attending the Previous Examinations appears to be considerably less. With reference to this point, I may observe, in explanation of that which might otherwise appear erroneous, that last year one of the largest Unions included all the Candidates examined at its Local Examination in the number returned as having attended the Previous Examination of the Society of Arts, and thus a very large number were included in it who had no intention, and little qualification, to proceed afterwards to the Society's Final Examination. Again, in another case last year in returning the number of those qualified to enter the Society's Final Examination, a considerable number were included who did not intend, or who were not able, owing to local circumstances, to attend it. Hence the numbers last year were unduly large. This has not occurred this year; and the important fact remains, that there has been an increase in the numbers actually attending the Final Examinations of nearly seventy per cent. over those of last year. In looking, too, at this increase, it must be remembered that Drawing has been omitted from this year's Examination, whilst last year there were 37 Candidates in Freehand Drawing and 34 in Mechanical Drawing. It is true that Music has been added, but this has produced 12 Candidates only.

Such have been the results of the present year, and certainly the Society may be congratulated on the great success which has attended the efforts of the Council in organising these Examinations. It is gratifying to note the careful attention which the Local Boards have given to the conduct of the Examinations, and the strictness with which they applied themselves to carry out the rules which the Society has been obliged to lay down for their guidance; indeed the Institutions owe to the gentlemen who have undertaken, gratuitously, the arduous and responsible duty of acting on the Local Boards, a deep debt of gratitude.

In consequence of the desire expressed at the last Conference that, as far as possible, there should be but one Local Board for each district, the Council endeavoured to promote the union of Boards in places where more than one existed. They have, however, been unable to effect this object; indeed, the convenience or inconvenience of several Boards in one place is a matter which, after all, must depend on local circumstances, rather than on any rigid rule to be laid down by a central authority acting at a distance from the locality.

Whilst speaking on the subject of the action of the Local Boards, I may be permitted to point out that, in some instances in the Previous Examinations, they appear to have been hardly sufficiently careful to test how far the qualifications of their Candidates fitted them for the Final Examinations. This, however, in no way affects the value of the Certificates awarded by the Society's Examiners; the only results have been the addition of unnecessary labour to those gentlemen, and disappointment to the Candidates. This subject is worthy the attention of the Conference.

The occupations, or intended occupations, of the 368 successful Candidates are as follows:—

Architects	5
Artist	1
Assistant Foreman	1
Assistant to Chemical Teacher	1
Assistant to Observatory Kew	1
Assistant Surveyor of Taxes	1
Blacksmith	1
Brass Founders	2
Boot and Shoemakers	3
Book-keepers	13
Booksellers & Stationers	4
Brushmaker	1
Builder	1
Butchers	2
Butler	1
Carpenters and Joiners.	2
Cabinet-makers	3
Carcase Butcher & Common Salesman	1
Cardwriter	1
Cashiers	3
Chemists and Druggists	8
Civil Engineers	3
Clerks	113
Cloth-drawer	1
Cloth-dresser	1
Colourmaker	1
Colonial Merchant	1
Carpet-weaver	1
Commission Merchant	1
Compositors	3
Cutler	1
Customs and Revenue Clerks	4
Clerk of Works	1
Dispenser	1
Drapers and assistants.	7
Engineers	18
Engraver	1
Engine-fitter	1
Edgetool-striker	1
Engineer's Clerk	1
File-cutter	1
File Manufacturer	1
Gardeners	2
Gentleman's Servant	1
Government Clerk	1
Governess.	1
Grocers and assistants	5
Grocer and Druggist	1
Hatter	1
Hosiers	3
House Agent	1
Ironmongers	2
Ironmoulder	1
Jeweller	1
Japanner	1
Labourer	1
Law Clerks	13
Lithographer	1
Manufacturer	1
Mason	1
Mechanics	6
Mechanical Draughtsman	1
Machine-maker	1
Millwright	1
Mining Engineer	1
Missionary	1
Oilmen	2
Optician	1
Organist	1
Overlooker	1
Penblade-grinder	1
Pattern-drawer	1
Pattern-makers	2
Porters	2
Printer	1
Planemaker	1
Plasterer	1
Presser and Stamper	1
Post-office Clerk	1
Railway Clerks	4
Reader for the Press	1
Royal Engineer	1
Saddler	1
Salesmen (common and others)	4
Schoolmasters	3
Schoolmaster (military)	1
Sailmaker	1
Slate Quarryman	1
Shipbroker	1
Shipwrights	2
Slubber	1
Surveyors and Clerks	6
Stover	1
Stockkeeper	1
Staghorn-cutter	1
Tailor	1
Timber Merchant	1
Telegraph Clerk	1
Teachers, Ushers, &c.	8
Warehousemen	16
Wastedealer	1
Watchmakers	3
Weaver	1
Wheelwright	1
Wireworker	1
Woollen-spinner	1
Woolsorters	6
Yarnsinger	1
Returned of no occupation	12

In the Appendix to this Report will be found various observations made by the Examiners, which, besides being interesting to the Candidates of the present year, will be found to contain valuable suggestions for the guidance of those proposing to undergo the Examination in future years. Tabular statements of the results of the Examinations are also given.

The wish expressed at the last Conference, that a new edition of the List of Lecturers should be prepared during the month of May, has been complied with, and a copy has been sent to each Institution.

During the year the Institutions have made very extensive use of the opportunity afforded by the Society for obtaining books at the reduction of 27½ per cent. discount on the published prices, and it seems evident that the value of this important privilege is becoming more and more appreciated.

The Society's itinerating collection of photographs, chromo-lithographs, &c., has received considerable additions during the past year, and is still in request among the Institutions.

It will be remembered that a Committee of the House of Commons last year, appointed to investigate the general question of Exemption from Rates, reported in favour of the repeal of all such exemptions, with very few exceptions, such as Churches and certain buildings actually belonging to the public; and this Session a Bill was brought into Parliament by the Government for the purpose of carrying the Committee's recommendation into effect. At the request of the Institutions in Union, the Council presented a petition to the House of Commons praying, on behalf of the Institutions, that any Bill which was passed into a law should not deprive them of their existing right to exemption. The Institutions themselves also presented numerous petitions to the

House of Commons; and other bodies throughout the kingdom, interested in the question, having expressed themselves strongly against the Bill, the Minister of the day was compelled to yield, and the Bill was not proceeded with.

At the last Conference a resolution was passed in favour of opening the National Museums and Galleries of Art in the evening. The Council of this Society, heartily concurring in the views expressed by the Institutions, have been in correspondence with the Trustees of the National Gallery, in reference to the new galleries about to be opened for the Vernon and Turner Collections; copies of this correspondence have been moved for in the House of Lords, and an inquiry has been set on foot by the Government to ascertain how far the wishes of the Institutions can be carried into effect, without injury to the pictures from the use of gas for lighting the galleries of an evening.

I am, Gentlemen,
Your obedient servant,
P. LE NEVE FOSTER,
Secretary.

APPENDIX.

The Examiner in Arithmetic says:—"I think there was a marked improvement this year in the papers submitted to me, as regards penmanship and neatness of execution; but I am of opinion that the arithmetical candidates are not equal in power to those of last year. There seems to be a slight falling off in the ability to apply principles to the solution of practical problems. This arises, most likely, from too great attention having been given to merely mechanical work, and a consequent partial neglect of a due investigation of the reasons upon which the various processes in arithmetic are based."

The Examiner in Book-keeping by Double Entry says:—"The great increase in the number of candidates, namely, from 2 in 1856 to 84 in 1859, shews that the importance attached to this subject and to the value of the Society's certificate, is advancing and extending. The average merit of the candidates is also higher and the result of the examination is, upon the whole, satisfactory to me.

"Of the 79 examinants to whom certificates were awarded, all except 10 were young men, upon whose occupations in life the knowledge of book-keeping by double-entry has a direct bearing, the great majority of the 79 being clerks, with a few warehousemen and tradesmen's assistants.

"The remaining 10 include a gentleman's servant, an engine-fitter, a butler, a gardener, and a slate quarryman."

The Examiner in Algebra observes:—"There is a difficulty in the way of pronouncing any absolute opinion as to the average character of the performances of the examinees, arising from the fact of their ages and circumstances being unknown to me: it is obvious that a set of answers of which I might think very little may argue much creditable application, and the contrary. However, looking simply to the papers, I observe that the same general feature pervades them which I noticed last year. That is, very little attention appears to have been given to the principles of the subject, and a good deal to the practical working of algebraic processes. I do not say that this is a fact to be lamented; if the candidates be young it is very desirable that they should be chiefly exercised in Algebra as a practical science, as a 'Universal Arithmetic;' probably also many of the candidates may have been led to study mathematics chiefly with a practical end in view. I may add that I was led, by what I observed of the examination last year, to make the paper of the present year considerably more simple. The questions of 1859 were, with a few exceptions, exceedingly simple, but the result has shown that I have not as yet gone too far in that direction. It may possibly be due to this cause, however—the great simplicity of the paper—that I have not had this year so many cases as in the year previous, of candidates who manifested total incompetency. There were two Candidates in the Examination of 1859, who should not (I think) have presented themselves, but there were several more than two in 1858. There were some who acquitted themselves very badly, but who perhaps had sufficient justification for entering the lists. One Candidate as I noticed in my previous report, far outtopped the rest. I do not know his age or his advantages, but certainly his papers were very creditable, and much superior to any produced last year. On the whole I should say that the Examination proves that considerable pains had been taken in teaching the elements of the subject, and that a very useful knowledge of it has been obtained by more than half the Candidates. I will conclude by again remarking that I think the paper of this year was abundantly difficult enough, however simple it may appear to an experienced mathematician."

The Examiner in Geometry and Mensuration reports as follows:—"The papers of 45 candidates were sent to me; of these 37 had sent up answers in pure geometry; 41 sent up answers to mensuration questions; only seven had restricted themselves entirely to mensuration; one had answered the numerical questions and also attempted geometrical problems; 13 out of the whole number had sent in answers to the problems.

"The best original answers were sent in by No. 288, who was third on my list; but those to whom I awarded the two first places came very near him in the merit of their answers to these questions; and had *also* done far more in the rest of the paper.

"The best answers in Mensuration were sent in by a candidate who did nothing else.

"I think the answers to problems from the 13 who attempted them were very creditable. Eight of the 13 did very well.

"On the whole I am well satisfied with the result. There was not a question in the paper which was not attempted by some candidate or other, and a considerable number of them showed that they had carefully attended to the subject.

"I think the answers on the whole rather better than last years answers."

The Examiner in Trigonometry says:—"With the exception of the Candidate placed in the first-class, the amount of knowledge and ability throughout was very ordinar This Candidate was really good, but not extraordinary."

The Examiner in Conic Sections, reports:—"The Analytical Conics have been well worked by No. 409—worked intelligently, so that it is clear that he understands the geometrical meaning of the symbols, but does not use them as signs and signs only. This result justifies the recommendation which Mr. Spottiswoode and I last year made to the Society, to include Analytical Conics within the range of subjects in which the Society examines."

The Examiner in Statics, &c., says:—"The general impression conveyed to my mind, as to the merits of the Candidates answering in Mechanics and Hydrostatics was upon the whole very favourable. A few appeared to have acquired only a very rudimentary knowledge of the subject, but sound as far as it went. Others had proceeded not only to a considerable acquaintance with the subject, taken experimentally, but also demonstrated mathematically; while one or two had pursued both lines of study to a very considerable extent."

The Examiner in Practical Mechanics says:—"The general character of the answers which I have received has not been satisfactory, and the Candidates do not appear to possess any extended knowledge of the principles involved in the application of Mechanical Science."

"The Examiner in Electricity, Magnetism, and Heat, has much pleasure in reporting a very satisfactory advancement in the knowledge of these subjects evinced by the Candidates this year. The answers of the two first Candidates are far superior to any previously received; the first especially manifesting a clear and accurate knowledge of almost every branch of the subject touched upon in the Examination Paper. He regrets, on the other hand, to have to notice several inaccuracies in spelling in the papers of one Candidate, and the almost total ignorance of all the subjects displayed by another."

The Examiner in Botany writes:—"I have no remarks of importance to make about the Botanical Candidates, of whom the number was so small. One thing only strikes me as curious; that there should be so few candidates in this subject, considering the large number of well-paid gardeners employed in this country, not to speak of agriculturists. This would give one the idea that their education is at present wholly empirical."

The Examiner in Political and Social Economy says:—"The impression made upon me by the answers to the questions which I had given was not so favourable as it was last year. There was especially a great deficiency in historical and statistical knowledge of subjects connected with political economy, and which supply the best practical illustrations of its principle; such, for instance, as the Navigation Laws, and the proceedings of the celebrated Bullion Committee of 1810. This deficiency, I admit, may be imputed in some degree to the want of suggestiveness, in these respects, in the list of books recommended by us. I would propose, therefore, that we should add to them, M'Culloch's Dictionary of Commerce, Porter's Progress of the Nation, and the Blue Book of Miscellaneous Statistics, lately published under the superintendance of Mr. Fonblanque."

The Examiner in Geography reports as follows:—"The total number of candidates' papers that I have inspected (in reference to Geography) is twenty-eight. The result has led me to award three first-class Certificates, seven Certificates of the second-class, and eleven of the third-class; while I reject seven of the number, as coming under the head of "not passed." Bearing in mind the class of society to which the writers of the papers may be assumed to belong, and the limited opportunities of study which they in all probability enjoy, I will not say that—looking at the answers as a whole—I am dissatisfied with the results. The average merit of the papers is equal to that of former years. But I am certainly less satisfied than I could wish to be, and it is mainly in the hope of being useful to future Candidates that I make the subjoined remarks. A clearer conception of the results to be aimed at, and a better knowledge of the method to be found in the task of preparation, would (I feel sure) have been productive of a more satisfactory issue. The chief fault which attaches to by far the greater number of the papers is want of precision. I do not mean precision of expression (for the absence of which every allowance should naturally be made to unpractised writers), but precision of knowledge—which, in the case of Geography, is indispensable, and which is only to be attained by methodical study, with diligent localisation of every fact that is acquired in the course of such study. It is in the elementary parts of the subject—those which involve the precise details of place—that the Candidates exhibit the greatest weakness. The mastery of such detail no doubt requires, on the learner's part, a good deal of hard labour (perhaps of what he may designate as "drudgery")—a kind of labour which I know, by experience, he is too apt to pass by in favour of what may wear a more scientific garb, and may appear to possess value of a higher order. But the mistake involved in such neglect is fatal to high geographical attainments; for all Geography (even the most scientific chapters of physical geography form no exception to the truth of the remark) is obviously based upon the precise knowledge of place. One or two references to the recent examination will help to illustrate my meaning. Out of 28 Candidates, 22 pass by, without any attempt at answer, question 8 of the "Physical Geography" division of the paper set*; and of the six answers given, two are failures. Similarly, in regard to question 9 (Physical Geography), only four answers are given, and only one of the number is a really good answer. To question 10 (Physical Geography), only four good answers appear, while fourteen Candidates pass it by altogether. In the division of Descriptive Geography, like results are apparent. The questions which ought to be answered best are too frequently passed over. Ten Candidates pass over No. 1 on the list, and seventeen Candidates pass over the question immediately succeeding. Only six Candidates select question 8 for answer, and only eight attempt answers to questions 9 and 10 on the list. The questions thus generally passed over are those that involve the precise and special detail of place—a kind of knowledge only to be gained by labour methodically employed. It is of course to be expected that where Candidates have the opportunity of selection, they will take the easiest (or what seem to be the easiest) questions, and I find no fault with so natural a proceeding. I only refer to the above instances as illustrating a general truth. The answers given to the questions that are selected display too often the same general fault—a want of precision as to fact, and an attempt at vague and wordy generalisation. This is the obvious result of insufficient and unmethodical study. If I had to give advice to any intending Candidates, I would say, "Be sure that you know the humbler part of geography thoroughly, before you aim at its higher and more scientific truths. Study diligently (even though the mastery of its details may involve not a little hard labour—even of drudgery) some elementry work on the subject, and always with the aid of constant reference to the map." A superficial acquaintance with such matters as the Gulf-stream or the trade-winds (however showy its appearance) will not compensate for the absence of precise knowledge respecting the height and direction of mountain-chains, the courses of rivers, the climate and productions of various lands—the positions of towns and other localities of note, whether commercial or historic. Above all, familarise yourself with the map of the world, and with that of your own country. By frequent exercise get the great natural features that are embodied in these maps so fixed in your mind as to enable you to sketch the more important of them from memory, with some approach to, at least, general truthfulness. Remember always that it is upon the precise knowledge of place that Geography is based, and to aim at scientific generalisation in the absence of these humbler details, is like the attempt to construct an edifice without securing the necessary foundation. I conclude these observations with the remark that I am able to bestow a high measure of commendation upon the three Candidates to whom I have awarded first-class Certificates, and that many of the papers which rank lower in result yet display an amount of information which is highly praiseworthy."

The Examiner in English History says:—"The general opinion which the examination in English History this year has given me of the Candidates is favourable. Some have answered very well; and nearly all gave proofs of having given considerable attention to historical subjects, and of retaining much historical knowledge in their memory. But a very great number showed by their omissions, as well as by their mistakes, that their reading had not been well-directed and systematic; and that they had neglected to acquire a full and accurate knowledge of

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* All the papers set at the recent Examination will shortly be published in the *Journal.—Ed. S. of A. J.*

TABLE I.—Return of the Number of Papers Worked in Each Subject, in the Four Years, with the Result for the Year 1859.

SUBJECTS.	1856.	1857.	1858.	1859.				
				No. of Papers Worked.	No. of First Class Certificates.	No. of Second Class.	No. of Third Class.	No. of Papers in respect to which no Certificates were given.
Mathematics	27	...	...	...	...	...	...	...
Arithmetic	...	77	159	232	29	44	73	86
Book-keeping	...	46	48	84	10	11	58	5
Algebra	...	58	74	82	2	8	47	25
Geometry	...	52	53	45	4	13	18	10
Mensuration	...	42	44					
Trigonometry	...	25	27	17	1	3	4	9
Conic Sections	...	14	14	4	1	1	2	...
Navigation, &c...	...	4	5	...	...	...	...	...
Physics	...	...	...	...	...	...	...	...
Statics, Hydrostatics, &c. ...	...	11	14	17	2	8	7	...
Mechanics	13	...	...	...	...	...	...	...
Practical Mechanics	...	9	8	7	...	1	4	2
Magnetism, &c.	...	9	4	5	2	...	2	1
Astronomy	...	...	5	...	...	...	...	...
Chemistry	16	22	13	28	5	11	8	4
Physiology	6	1	6	2	...	...	2	...
Botany	2	1	2	2	...	1	1	...
Agriculture...	4	2	0	...	...	...	...	...
Political Economy...	...	6	3	14	1	1	5	7
Geography	23	28	...	28	3	7	11	7
Descriptive Geography... ...	...	...	29	...	...	...	...	...
Physical Geography	...	...	17	...	...	...	...	...
English History	38	24	43	38	3	10	11	14
English Literature...	17	17	33	30	3	5	16	6
Latin and Roman History... ...	15	19	12	18	3	5	5	5
French	17	38	68	87	8	20	22	37
German	7	15	13	14	1	3	6	4
Drawing	7	...	...	...	...	...	...	...
Free-hand Drawing	...	4	37	...	...	...	...	...
Mechanical Drawing	...	3	34	...	...	...	...	...
English Grammar and Composition	11	...	...	...	...	...	...	...
Music	...	...	...	12	...	2	6	4
Totals				766	78	154	308	226

the elementary parts of History before proceeding to its more ambitious portions. I wish very much that our students would bear in mind how much sound learning exceeds showy learning in value. Even with reference to the very limited object of doing well in our examinations they will find this to be true. The student who gives fair answers to the simple set of questions which come first in the Examination Paper, will gain a place though he leaves the more difficult questions at the end of the Paper nearly untouched. On the other hand, the Candidate who shows himself ignorant in elementary matter will be pretty sure to be plucked, notwithstanding his penning a specious essay or two in answer to some of the more difficult interrogatories. I also wish that the Candidates could be taught not to extend their answers beyond the matters as to which they are questioned. Many of them waste their time in writing about things as to which they have not been asked. No marks can be gained by such irrelevant displays, and the time also is never too long for the exigencies of the question."

The Examiner in English Literature reports:—"As this is the first time I have conducted the Examination in English Literature, I can make no comparison between the papers of the present and those of former years. But my impression is, that a fair proportion of the candidates have acquitted themselves with credit. The general result has certainly not fallen short of the expectation which I had formed. I have not been surprised to find that the prevailing fault shown in the papers, is the want of a sound acquaintance with the text of the books brought up for examination. Most of the Candidates appear to have given way, in a greater or less degree, to the intellectual temptation of reading criticisms, and picking up information respecting the authors, while they ought to have been carefully studying the words of the books themselves."

The Examiner in Latin and Roman History reports as follows:—"The Candidates in general acquitted themselves creditably. Their deficiencies were of two kinds. Those who did the best were deficient in English. Their translations were accurate, or nearly so; but not nearly as good English as they could have been made without at all departing from the letter of the original. The deficiency of the inferior Candidates was chiefly shown in inaccurate parsing. Those who cannot parse can never translate, although it is not an uncommon delusion to fancy that it is possible to reach the sense of a passage by a sort of intuition independent of the grammar. Altogether, however, the work was very fair."

The Examiner in French in reporting says:—"I feel great pleasure in stating that I have on the whole been well pleased with the papers on this occasion, and I have found in them a marked improvement as compared with

TABLE II.—COMPARATIVE RESULTS OF THE EXAMINATIONS OF 1858 AND 1859.

NAME OF LOCAL BOARD.	No. of Candidates Examined at the previous Exmn. by Local Board.		No. of Candidates who passed previous Examinations.		No. of Candidates Examined at the Final Examination.		No. of Candidates who passed Final Examination.		No. of Papers worked at Final Examination.		No. of 1st Class Certificates Awarded.		No. of 2nd Class Certificates Awarded.		No. of 3rd Class Certificates Awarded.		No. of Prizes Awarded to Candidates.		No. of Prizes Awarded to Local Boards.		No. of Prizes Awarded to Institutions.		No. of Unsuccessful Candidates.	
	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859	1858	1859
Aberdeen	...	48	...	39	...	32	...	18	...	60	...	...	...	4	...	19	...	...	...	...	...	...	...	14
Ashbourne, Lit. I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Ashbourne, W.M.I.	...	4	...	4	...	4	...	2	...	4	...	...	...	...	...	2	...	...	...	...	...	...	...	2
Ashford	...	4	...	2	...	2	...	2	...	4	...	2	...	...	...	2	...	...	...	...	...	...	...	...
Bacup	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Banbury	2	4	2	4	2	3	2	1	4	4	2	...	2	...	...	2	2	...	...	...	2	...	...	2
Basingstoke	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
*Bedford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Belfast	...	18	...	17	...	13	...	7	...	21	...	...	...	1	...	7	...	...	...	...	...	...	...	6
Berkhampstead	10	...	10	...	8	...	6	...	8	...	...	...	3	...	3	...	...	...	...	...	...	...	2	...
Birmingham, I.,	...	27	...	22	...	18	...	14	...	22	...	3	...	8	...	6	...	1	...	...	...	1	...	4
,, Chance's Lib.	2	14	2	7	1	7	1	2	3	8	...	2	1	...	1	1	...	1	...	...	...	...	...	5
Blackburn	15	9	5	9	4	5	2	1	10	7	1	...	2	1	3	1	...	...	...	...	...	...	2	4
Blandford	...	6	...	3	...	3	...	3	...	5	...	...	...	1	...	3	...	...	...	...	...	...	...	...
Bradford, Yorks.	23	24	17	22	17	20	16	19	26	33	1	4	13	6	9	20	...	1	...	...	...	...	1	1
Brighton, for Sussex	3	3	3	3	2	1	2	1	4	2	...	...	2	1	1	1	...	...	...	...	...	...	...	...
Bristol, Athenæum	11	16	11	14	9	14	8	12	15	29	3	9	8	8	3	8	2	7	...	1	1	...	1	2
Bucks. and Berks., Lecturers' Asso.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bury, Athenæum	...	6	...	4	...	4	...	4	...	4	...	...	...	2	...	2	...	...	...	...	...	...	...	...
Canterbury	...	3	...	2	...	2	...	1	...	2	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Carlisle	...	4	...	4	...	3	...	1	...	3	...	...	...	...	...	1	...	...	...	...	...	...	...	2
Carshalton	...	2	...	2	...	2	...	2	...	4	...	2	...	...	...	3	...	...	...	...	...	...	...	...
Chelmsford	...	1	...	1	...	1	...	1	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	...
Dover	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Frome	...	3	...	3	...	3	...	2	...	4	...	1	...	...	...	2	...	...	...	...	...	...	...	1
Glasgow, M.I.	...	48	...	42	...	41	...	36	...	63	...	8	...	21	...	24	...	2	...	1	...	2	...	5
,, Athenæum	...	24	...	24	...	24	...	17	...	29	...	4	...	10	...	7	...	2	...	...	...	...	...	7
,, Inst.	...	4	...	4	...	3	...	2	...	3	...	...	...	...	...	2	...	...	...	...	...	...	...	1
Greenwich	1	...	1	...	1	...	1	...	2	...	1	...	1	...	...	...	...	...	...	...	...	...	...	...
Halifax, M.I.	35	4	17	4	12	4	10	4	18	5	3	4	7	...	4	1	1	3	...	1	...	1	2	...
,, W.M.Coll.	67	28	21	14	15	14	11	12	23	20	1	3	4	4	10	7	...	...	...	...	...	...	4	2
Hanley, "Potteries" M.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Hartlepool, (West)	6	4	3	4	2	4	2	3	5	7	...	...	2	...	3	5	...	...	...	...	...	...	...	1
Hitchin	...	2	...	2	...	2	...	2	...	3	...	...	...	...	...	3	...	...	...	...	...	...	...	...
Holbeck, near Leeds	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Holmfirth	...	1	...	1	...	1	...	1	...	3	...	...	...	...	...	3	...	...	...	...	...	...	...	...
Ipswich	7	10	6	8	5	4	4	2	11	6	...	1	5	...	4	2	...	...	...	...	...	...	...	...
Leeds, M.I.	13	5	10	4	10	4	8	4	22	10	2	...	6	2	7	6	2	...	...	...	1	...	2	2
,, Y.M.C.I.	14	42	14	39	14	37	11	29	43	68	5	9	9	8	10	32	3	2	...	1	2	...	3	7
Leicester, Ch. of E. I.	...	13	...	13	...	13	...	13	...	21	...	5	...	8	...	6	...	1	...	...	...	...	...	...
Lewes	2	...	2	...	1	...	1	...	5	...	...	...	2	...	1	...	...	...	...	...	...	...	...	...
Liverpool	35	21	35	19	32	15	16	12	56	29	3	...	8	4	17	16	...	...	...	...	...	...	16	2
Lockwood	1	2	1	2	1	2	1	1	2	2	...	...	1	...	...	1	...	...	...	...	...	...	...	1
London, Ry. Polytec.	29	20	8	14	14	11	12	10	29	18	4	4	4	3	13	7	2	2	...	...	...	1	2	1
,, Crosby Hall	27	35	25	35	24	34	17	25	39	48	11	5	8	11	19	17	6	2	1	...	3	1	7	9
,, Domestic Miss'n	1	2	21	2	1	2	1	1	3	2	...	...	2	1	1	...	...	...	...	...	...	...	...	1
,, Jews' & General L.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,, M.I.	12	10	8	10	6	9	5	8	13	12	4	1	6	3	1	6	...	...	1	...	...	...	1	1
,, Tailors' Labour Agency, L.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
,, West Brompton	4	...	4	...	3	...	3	...	6	...	...	...	3	...	2	...	...	...	...	...	...	...	...	...
Longton	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Louth	4	3	4	3	4	3	4	2	5	4	...	...	...	1	4	1	...	...	...	...	...	...	...	1
Lymington	1	...	1	...	1	...	1	...	5	...	1	...	3	...	1	...	1	...	...	...	1	...	...	...
Lynn, (King's)	...	3	...	3	...	3	...	3	...	7	...	1	...	3	...	1	...	...	...	...	...	...	...	...
Macclesfield	83	...	83		8	...	4	...	12	...	1	...	...	...	5	...	...	...	...	...	...	...	4	...
Manchester, M.I.	32	36	32	31	24	26	10	21	39	48	...	3	8	10	10	22	...	1	...	...	...	...	14	5
,, Inst. Assoc'n	591	...	100	...	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Middlesborough	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Neath, M.I.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Newcastle-on-Tyne	3	7	3	7	3	7	3	6	5	14	...	...	1	2	3	6	...	...	...	...	...	...	...	1
Northowram	1	1	1	1	1	1	1	1	4	3	...	...	...	1	3	2	...	...	...	...	...	...	...	...
Paisley	...	2	...	2	...	2	...	1	...	3	...	...	...	...	...	1	...	...	...	...	...	...	...	1
Pembroke Dock	4	5	4	5	4	5	4	4	13	9	1	1	5	2	6	4	...	1	...	...	...	...	...	1
Portsmouth	2	5	2	5	2	5	2	5	13	15	3	2	5	4	4	6	3	...	...	...	4	...	...	...
Richmond, (Surrey)	...	5	...	4	...	4	...	4	...	7	...	1	...	2	...	2	...	1	...	...	...	...	...	...
Salford	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Salisbury	1	...	1	...	1	...	1	...	4	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...
Selby	10	12	9	10	9	7	3	5	11	15	...	1	2	1	2	8	...	...	...	...	...	...	6	2
Sheerness	1	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Sheffield	20	42	18	35	16	32	9	26	23	47	3	2	3	12	5	23	3	1	...	...	2	1	7	6
Skipton	...	2	...	2	...	2	...	2	...	4	...	...	...	2	...	2	...	...	...	...	...	...	...	...
Slough	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wakefield	4	4	4	2	4	2	3	2	6	3	...	...	...	2	5	1	...	...	...	...	...	...	1	...
Warminster	1	3	1	2	1	1	1	1	2	1	...	...	1	...	1	1	...	...	...	...	...	...	...	...
Waterford	...	25		16		6	...	2	.	6	...	...	...	2	...	...	...	...	...	...	...	...	...	4
Wigan	9	5	6	5	6	5	5	2	11	6	...	...	2	...	5	2	...	...	...	...	...	...	1	3
Windsor	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Wirksworth	...	3	...	2	...	2	...	...	...	2	...	...	.	...	...	...	...	...	...	...	...	...	...	2
York	11	7	7	6	7	6	5	6	14	6	3	2	2	1	5	1	...	...	...	...	...	...	2	2
TOTAL	1107	641	501	544	288	480	197	368	516	766	53	78	132	154	176	308	25	28	2	4	16	7	79	112

* Not now in Union.

the preceding years, more particularly with the last; for, whilst I was unable last year out of 68 Candidates to grant a single First-Class Certificate, I have found this year eight Candidates out of 87 worthy of that distinction; my standard of excellence having been raised rather than otherwise."

The Examiner in German says:—"I have no materials at hand by which I could form a decided estimate as to the difference between the work placed before me in the last Examination and that I had to investigate in former years. My impression, however, is that it was decidedly better than that of last year; yet, on the whole, inferior to that of 1857. It does not seem to me that the Local Boards have admitted Candidates for examination in my department who ought to have been rejected."

The Examiner in Animal Physiology says:—"The very small number of Candidates who presented themselves for Examination in Animal Physiology this year precludes the deduction of any general inference from the examination, unless, indeed, what may be gathered from that fact itself. In respect of the knowledge evinced in the answers, whether as to extent or precision, the Examiner is unable to report any advance since the last year."

The Examiner in Music reports:—"I consider the Music Papers very unsatisfactory, both in regard to number and quality. I did not find one fit for admission into the first class, and several I could not class at all. Most of the Candidates would doubtless have done better had they confined their attention to the elementary questions; several of them having evidently attempted the harmony paper without the slightest preparation for it, and apparently without any idea that any such preparation was needed. This result must not be accepted as any evidence of the state of musical power in this country. Musical students are at present more used to have their knowledge tested in practical performance than on paper, and shrink therefore from exclusively theoretical tests."

TABLE III.

This Table shows the Ages of the 525 Candidates whose Return Papers were received; of these 480 underwent the final examination.

Age.	No. of Candidates.	Age.	No. of Candidates.
16	52	30	9
17	68	31	6
18	77	32	5
19	64	33	6
20	54	34	1
21	44	35	1
22	36	36	2
23	23	37	2
24	16	38	1
25	21	39	3
26	11	41	1
27	4	43	1
28	6	44	1
29	8	47	2

A report of the proceedings of the Conference will be given in the next number of the *Journal.*

ONE HUNDRED AND FIFTH ANNIVERSARY DINNER.

The One Hundred and Fifth Anniversary Dinner of the Society took place at St. James's Hall, Piccadilly, on Tuesday, the 28th instant. The Right Honourable Lord Napier presided.

Grace having been said by the Rev. Canon Girdlestone,

The Chairman rose and said—No observations which I am enabled to make could enhance the virtues of our Sovereign, or stimulate the loyalty and devotion of this assembly. I shall, therefore, without further preface, give you "The health of Her Majesty the Queen."

The toast was drunk with customary honours.

The Chairman said—I rise to propose the health of His Royal Highness the Prince Consort, the Prince of Wales, and the rest of the Royal Family. When I name H. R. H. the Prince Consort, I allude to one who is endeared to all Englishmen by the virtues which he has constantly displayed in his exalted station, but who has peculiar claims to our gratitude and respect as the President of this Society. Nor is the Presidency of H. R. H. a vain compliment or empty ceremony. The Prince Consort is associated with the Society of Arts by offices of earnest and mutual benevolence, and by a common zeal for every enterprize which can conduce to the moral and industrial prosperity of our country. Referring to H. R. H. the Prince of Wales, I am confident that I utter the sentiments of this assembly when I say that we watch the opening of his bright career with affectionate solicitude, and that from what we already know, we draw the happiest auguries of his future welfare and of our own. I give you, "The health of his Royal Highness the Prince Consort, President of the Society of Arts, the Prince of Wales, and the rest of the Royal Family."

The toast was duly honoured.

The Chairman said—In rising to address you on this occasion I am sensible of my incapacity for the task which I have undertaken, and I feel that the previous studies and experience of my life cannot enable me to do justice to the momentous questions which have been committed to my treatment. If I be asked, then, why I have accepted the flattering proposal which has been made to me, I answer, because I belong to a profession which has been often unjustly associated with frivolity or artifice, but which when rightly practised and rightly understood, is strictly allied to the weightiest interests of our country, and especially with the welfare of our manufactures and foreign commerce, in which you are so deeply concerned. I could not, therefore, deny myself the honour and advantage of mixing for a moment in this intellectual movement, and of meeting in this eminent position such a numerous and influential assembly of my countrymen. Gentlemen, as I was little prepared by previous knowledge, to recapitulate the proceedings of this Society during the past year, I have been favoured by the Secretary with the perusal of the draft of a report which will shortly be offered to your own inspection. In that document I observe that the Committees and Council of the Society have been occupied with subjects comprising the three great branches of national interest to which you are devoted,—Arts, Manufactures and Commerce. With reference to arts, I find that the attention of the Society has been directed to the momentous question of copyright in works of Art, and though, owing to the interruption of public business contingent on the recent dissolution, the project of law embodying the views of the Society, has not been submitted to the legislature, it is hoped that ere long it will be laid before Parliament. In regard to manufactures, two specialities have been dealt with, the use of gutta percha as a material in our fabrics; and the comparison and improvement of surgical instruments. For the benefit of Commerce, the Society have been endeavouring to draw public attention to the advantages which our colonies afford, whether for the purpose of traffic or settlement; and I make little doubt that when the correspondence which has been entered on with our various colonial possessions has been sufficiently perfected, results will be obtained highly beneficial to the mother country. In the common interests of all the branches of public improvement for which it is formed, the Society has continued its labours for the expansion of its system of examinations; and it has likewise endeavoured to promote the project of an international Exhibition in the year 1861. The results of the Examinations for the past year, will, when printed, prove highly satisfactory to the Society and the public. The design for another International Exhibition obtained great encouragement from many influential parties, but the aspect of the times has unhappily proved unfavourable to this useful project. The public interest in so great an undertaking could not fail to be checked by the absorbing excitements of the war, and the co-operation of the Continental States would, for the same reason, be materially curtailed. The plan of the Exhibition has been therefore laid aside till a more convenient season. In short, gentlemen, the energies of the Society have, during the past year, been well expended, but even if it were otherwise, and if it were not my duty to report to you any novelty or innovation in the working of your well-ordered system, it would still become you on this festive occasion to consolidate your union and animate your enterprise by reaffirming the great necessities of the nation and the time, and by proclaiming anew the important purposes for which you are embodied. It cannot be too often repeated that more than half the population of the British empire live by arts, manufactures, and commerce—(Hear, hear)—that is, they subsist on the results of skilled labour, or labour directed by speculation, invention, and design, in contradistinction to the simpler forms of industry, still for the most part associated with the culture of the soil, and which are more directly governed by material laws. A vast proportion of the manufactured productions of the British people are exported to foreign countries, where they have to compete with the domestic manufactures of those countries, often guarded by protective tariffs, or with the productions of other states stimulated by commercial rivalry and administrative encouragement. Nor are the resources of the home market to be enjoyed in security or negligence; for though we possess in the unrivalled mineral structure of our soil a broad basis of natural advantages, and though we derive from the thrift and contrivance of our ancestors a noble heritage of accumulated capital and knowledge, yet we can only maintain our superiority by ceaseless vigilance and exertion, and we may not expect any artificial defence by a recurrence to the prohibitive system. (Hear, hear.) The industrial movement of England at home and abroad is therefore one of anxiety and strife, and it is our bounden duty to levy from every department of intellectual inquiry auxiliaries in maintaining and enlarging our present ascendancy. If we be true to the examples of the past and watchful of the present emergencies I would not speak with apprehension of our commercial future. Far from thinking that the universal demand has attained its full proportions, or that British industry has necessarily reached its culminating point, I conceive that the powers of consumption in the world never appeared so capable of indefinite expansion, and that the incalculable activity of another age may revert with curiosity, and perhaps with indulgence, to the respectable efforts of the nineteenth century. (Hear, hear.) Passing over the home demand, which is susceptible of a steady development proportioned to the increasing numbers and wealth of the nation, there is much of an encouraging nature in the prospects of the foreign market, whether we regard those half civilized nations which take off the commodities of common utility, or those communities at a higher stage of culture which afford a market for articles of luxury and beauty. Gentlemen, the ancient and stagnant empires of the East, recently disturbed by our diplomacy and arms, swarm with a population equal to the united numbers of Europe and America. Surely we are justified in expecting that the vehicles of our exchanges with those regions will not long continue to be silver and opium, the former of which owes no portion of its value to the manipulation of the British artisan, while the latter is the creature of monopoly and the cause of demoralisation. (Hear, hear.) It is not enthusiastic to anticipate that when the barriers of traditional prejudice and fiscal exaction are dissolved, the multitudes of China and Japan will gradually unfold an immense market for the ordinary fabrics of Europe. Turkey, Persia, and Central Asia, without any important staple of exportation, and inhabited by a sparse, indigent, and in part vagrant, population, approximately estimated at forty millions, annually absorb more than seven millions' worth of British manufactures. At the same rate the inhabitants of the remoter East, who must eventually exhibit greater faculties of consumption and exchange, would draw annually sixty millions' worth of goods from Great Britain—an amount equal to more than one half of the produce of the United Kingdom exported abroad. (Hear.) If Brazil be selected as the standard of comparison, a far higher result would be obtained. Add, then, to those portions of Asia but half appreciated and explored the nations of India, Africa, and the Pacific Archipelagos, all of which are, by conquest, commerce, or conversion, being subjugated to European ideas and manners, and the boundaries of our uncivilized market appear to recede into an impenetrable distance. But, gentlemen, the aspirations of the British people, and those which guide the Society which I have the honour to address, are not limited by the grosser conceptions of cheapness and quantity. (Hear.) It must not be alleged that the gracious genius of English industry merely drudges in the service of a barbarous demand. It is our aim to invest the most familiar and useful objects of manufacture with some appropriate charm, and to rival the accredited seats of cultivated labour in the production of articles of a purely decorative and æsthetic character. If the markets of continental Europe be partly closed against us by the existence of older establishments, or by the force of conventional fashion, or by the obstinate impediments of illiberal legislation, we may still find in the new markets of rising states, in those which have been planted by the adventure of our own race on the plains of America and Australia, a fair field and ample scope for the higher departments of invention and design. (Hear.) The discovery of gold has been the chief instrument in the formation of the markets to which I allude, and it will long continue to be the basis of their prosperity. The importance of that discovery is not to be sought so much in the amount added to the circulating medium, or in a general rise of prices, which is precarious, and in part delusive: it is to be found in the sudden dispersion over vacant countries of men furnished with all the faculties and feeling all the necessities of civilization, engaged in a description of labour requiring neither capital nor combination, nor considerable consumption of time, but resulting in the delivery of a commodity which, if it does not directly add to the mass of productive capital, is at least always in the highest demand, and subject to the smallest fluctuations of value. In no other inconceivable form could twenty millions' worth of exchangeable produce have been annually raised with such celerity, and no motive save the intoxicating cupidity belonging to the pursuit of the precious metals could have impelled mankind to such immense migrations. (Hear, hear.) Nor is the consequence of this great movement of the English race to be measured by the mere value of the precious metals now or hereafter collected, for while one portion of the population set on foot by that primary incentive, sift the auriferous soil with increased assiduity, or apply more scientific processes to the reduction of the rock, or carry their insatiable inquisition and predestined power over those desolate empires, escaping from the paralysed grasp of the Spanish colonist; another portion are ever betaking themselves to various kinds of accessory labour, and to the creation of other articles of traffic which, though not in such instant demand, will, in the long run, become a profitable addition to general commerce. If it were compatible with the nature of this occasion to enlarge upon the topics which I have hastily touched, it would not be difficult to show that the wants of other nations and the dissemination of our own are sufficient, if wisely used, to provide abundant employment hereafter for the industrial energies of England. I also humbly think that, whether we regard the government of the country, or the forces spontaneously operating in the ancient and complex frame of our society, there are many causes uniting to afford an intellectual and artistic education to the working orders commensurate to the task which lies before them. And first, with respect to the action of government and parliament there is now, perhaps, in principle, as much direct intervention as is consistent with the spirit of our free institutions. In the British Museum, at Hampton Court, in the National Gallery, at the Kensington Museum, and in other repositories of national possessions, the historical examples of arts and manufactures are rapidly accumulating, which we hope to see placed in magnificent and instructive combination, and which will then only obtain their full value for imitative and suggestive purposes. In 78 schools of design, cheap instruction is afforded to 79,000 pupils, whereby the poorer classes have the opportunity of discovering and improving gifts of native genius, and although I shall not venture to affirm that our public edifices and monuments recently constructed can be regarded with unqualified approval, we may at least hope that the Government has a poignant sense of past errors, and it has certainly shown a desire by pecuniary rewards and competitive exhibitions to draw the highest talent to the service of the state. Allied with the government of England, or sanctioned by our laws, you find many institutions of a corporate character, which though not designed for the encouragement of arts, must yet, in an intelligent and critical age, by their opulence and associations, become powerful vehicles in fostering the principles of good taste. The Church of England has been a main instrument in the correct and discriminating revival of the mediæval styles. The universities in repairing and enlarging their venerable establishments must have greatly contributed to the same result. Every cathedral should be a seminary for musical, architectural, and sculptural training, and we have seen at Canterbury, Norwich, Ely, and elsewhere, how chapters even may become profitable guardians and stewards of the structures and revenues committed to their charge. The Temple and Lincoln's-inn illustrate the munificence and ability of the legal bodies, while many buildings belonging to banks, municipalities, and railways, prove by their beauty how far our citizens and commercial companies are removed from a sordid economy, and afford a proper theatre for the introduction of new materials and forms, as well as for mechanical adaptations of an ingenious and unprecedented character. Next in order might be enumerated an array of institutions founded and supported for the direct promotion of the sciences, the arts, and manufacturing industry. Foremost in antiquity and glory stands the Royal Society. The Royal Academy, the Arundel Society, the Society of Antiquaries, the Art Union, the Institution of Civil Engineers, and a score of others, have all their zealous adherents and proper spheres of activity, deserving the highest commendation for the value of their inquiries or the beauty of their records. The Society which is assembled round this table may, without disparagement to others, assert peculiar and unexampled features of honour and utility. On the 105th anniversary of its existence it may reflect with pride on its long stability; it can claim as its President the first subject of the realm by his august position, and second to none in earnestness and knowledge—(hear, hear)—many illustrious names and titles have been written on its rolls; but while it is invested with the dignity of the past, it acts with the enthusiasm of the future—(hear, hear)—it has cast open its gates to the people, and become the central figure and the animating spirit of a great industrial confederacy numbering more than 300 members—I allude to the Society's Union of Institutions. (Hear, hear.) Finally, gentlemen, it is certain that neither governments, nor corporations, nor societies, can be profitable agents without a generous, responsive, and critical public. History shows how acaedmies may go on teaching and prating amidst general sterility. There will not be intelligent producers without intelligent purchasers. But the industry of England is nourished from a thousand silent and spontaneous sources. (Hear, hear.) Our treasures are not only laid up in museums, like grain in warehouses; they are also scattered in our homes like good seed in pleasant and fruitful places. Many do not worship in the public temple who have built domestic altars to the arts. (Cheers.) Consult those quiet habitations of the beautiful and good, how many modest deeds and gentle voices attest the prevalence of a beneficent culture. Such multitudinous though insensible influences are ever conspiring with your disciplined efforts to diffuse a better education below, an education which shall regulate the strong intellect and exalt the quick invention, and fix the bewildered taste, and rear up in England a working class capable of ministering to refined delights, capable, too, of labouring with consciousness and understanding, of sharing a divine satisfaction in beholding and approving their accomplished work. I give you, "Prosperity to the Society for the Encouragement of Arts, Manufactures and Commerce." (The noble lord concluded his address amidst enthusiastic applause.)

The toast was then drunk with great cheering.

Mr. Thomas Webster, F.R.S., responded to the toast. He congratulated the assembly upon the speech which they had just listened to from their noble chairman. He had attended many anniversaries of this Society, and he said without hesitation—and he was sure they would all respond to it—that such a speech had rarely, if ever, been heard upon occasions like the present. Such a speech, indeed, could not have been conceived and delivered by any one but a man of remarkable attainments and extraordinary opportunities of observation. They were happy in having for their president that evening a descendant of that remarkable man to whom they owed that wondrous system of calculation which had so materially aided the advancement of science and its practical application. Their chairman had had practical experience in that great and mighty republic—that noble institution across the Atlantic, of which no type existed in this country so perfect as this Society. He could, therefore, conceive that such a man was quite competent to the speech which had been delivered on the present occasion—indeed, he regarded his lordship as a worthy representative of this Society, which might be called the great republic of arts, manufactures, and commerce. They must all be proud of the occasion on which they were now assembled; they might well be proud of the successful meetings of the Society, whether at the Crystal Palace or in that beautiful hall—the two structures being mighty emblems of those principles which the Society of Arts had laboured so successfully to establish—triumphs of art which would long be remembered as evidences of the progress of our age. He could not but feel extremely gratified at the review which the noble chairman had given them of the progress already made, and of the future capabilities of this and other countries to further develop arts, manufactures, and commerce. His lordship had shadowed forth the uses of our cathedral establishments in a way that had never entered his (Mr. Webster's) mind before, for he had considered these structures as being appropriated to special occasions and objects; but his lordship had pointed out a different light in which they were to be regarded. He must, however, be permitted to say that in one respect his lordship had scarcely done justice to the Society of Arts; he had spoken of the culture of the soil not so much as a science, but as an occupation which might be carried on successfully by men in a primitive state; but perhaps his lordship was hardly aware how much the Society of Arts had done in advancing the science of agriculture, and in showing that the successful cultivation of the soil was as much dependent upon the skilful and scientific means employed, as any of the numerous branches of our manufactures. There were many other matters in which the Society of Arts had occupied a prominent position, but he would not take up their time by adverting to them. When he saw present such men as Mr. Chance, of Birmingham, and when he reflected what had been done by the repeal of the excise law as regarded glass in connection with the beautiful structures to which he had alluded; when he saw around him such men as Mr. Mechi, Mr. Fairbairn, and Mr. George Wilson, and when he remembered his friend Mr. Owen Jones, whose refined taste had designed that beautiful hall, all these gentlemen being members of the Society, he felt that such instances might be said to justify the favourable remarks which the noble chairman had made. When they looked to the wonderful expansion that had taken place in the arts and sciences; when they remembered that the Society of Arts was the first to bring before the public attention that remarkable product, gutta percha, and to point out its varied uses and applications; and when they reflected that Sir Charles Pasley, whom he saw near the chairman, was amongst the first who told them what the galvanic battery was capable of doing, and demonstrated, on a small scale, how he could level with a blast the massive cliffs of Dover, he could not but think that that was the shadowing forth of a time when the earth should be encircled by the telegraph wire, and when across the Atlantic the contents of the *Times* should be read, in point of time, some half-hour earlier than they were in this country. These were considerations of which they might well be proud. Knowing what had been the history of the Society of Arts, that it was second in antiquity only to the Royal Society, and regarding the latter as the pioneer of the abstract sciences, and the Society of Arts as the pioneer of the practical sciences, he repeated they might well be proud of the position they occupied. Let them look at the state of things fifty or even twenty-five years ago, and he would say that the Society of Arts had shown to the world the landmarks of the progress which had led to results at which they must all rejoice, and to which he saw no limitation. He believed the destiny of England was—as had been well said by the late member for North Lancashire—the destiny of England was to bring all mankind under broadcloth. With reference, however, to the sentiment of the chairman respecting the prospect of things in the East, he trusted the time was not far distant when those scandalous trades to which allusion had been made, if not altogether extinguished, would be greatly discouraged; for he was quite persuaded that opium and Christianity could not exist together.

Sir **THOMAS PHILLIPS** said he was deputed to invite the present assembly to drink to the health of the members of the House of Commons, connecting with that toast the name of Mr. William Stirling. The present House of Commons had been called into existence at a time of some perplexity, and it would be difficult for any man to cast its horoscope. For a period of nearly half a century—at least for more than forty years—the House of Commons had had to deal with peaceful questions only,—matters involving the welfare of the inhabitants of this island. It had had to deal through a great part of that time with various questions of reform, alteration of the law, and subjects affecting the social amelioration of the people. It had now, he feared, to deal with subjects of a very much more difficult and perplexing character. The plains of Italy were now devastated by war. Blood had been shed, suffering of no small amount had been produced, and the hoof of the war-horse had been imprinted on those fields where peace and fertility so long had reigned. What might be the lot of England, no one could tell, though it did not become them with bated breath to express the feelings of Englishmen. He apprehended they all felt that the duty of the House of Commons at the present day was to see, at least, that England herself was safe. He had no desire to express suspicion of the good faith of the remarkable man who ruled over a neighbouring country, but England must "to herself be true." She must depend upon the good faith of no man. She must be prepared to defend herself against all comers, and it did not become the English nation to alternate between overweening confidence and unworthy fear as to the conduct of any foreign power. He felt that they would expect from the House of Commons whatever could be done to protect England from injury and aggression. That seemed to be their mission in the present day, and he asked those present to sanction the expression of that opinion when they drank to the health of the House of Commons.

The toast having been duly honoured,

Mr. **WILLIAM STIRLING**, M.P., could assure them that he felt greatly embarrassed at being called upon to return thanks on behalf of a body for which the most distinguished member might hesitate to make himself responsible. But at a dinner of the Society of Arts the House of Commons perhaps had a right to be remembered. In the press and hurry of public business, it rarely happened that matters of this kind were expounded to that assembly in the eloquent and forcible terms in which the objects and ends of the Society of Arts had been explained by the noble chairman that evening. It was very rarely indeed that eloquence of that nature, even on subjects in which they were all deeply concerned, was addressed to the House of Commons, where unhappily there were some who were careless of, and some few perhaps hostile to, such objects as the Society had in view, but such eloquence was necessary to stimulate their zeal and prompt their generosity; though he thought they would admit that upon the whole, during a long course of years, the House of Commons had not been unmindful of those objects. He therefore ventured to think that, in drinking the health of the House of Commons on this occasion, this great Society had only added one more incentive to them to do that which he was sure the House was willing to do, and in which he was sure they were also fulfilling the desire of their constituents, as they were also fulfilling their duty to the British people—he meant the furtherance and encouragement of arts, manufactures, and commerce. As regarded the other subjects alluded to, he had only lately come from his constituents, and he ventured to say that that portion of the British dominions was unanimous in the desire that peace should be preserved, but that England should be prepared for war. He hoped, therefore, that in the new House of Commons they might look for the carrying out of that policy which Sir Thomas Phillips had placed before them.

Mr. J. P. **HENNESSY**, M.P., said—The hon. member for Perthshire had told them that the Society of Arts should remember the House of Commons; he ventured to think that the House of Commons should remember the Society of Arts. He would tell them why he thought so. Of all the Societies which had adorned and enlightened this country, no Society had done more for the practical objects which the House of Commons discussed in every session, than this Society had done. It was not alone in arts, manufactures, and commerce, that this Society had set an example to the Legislature. There was another subject intimately connected with them—one of vital importance to England—one often discussed in the House of Commons—and one which this Society had done more to promote than any other body in the country of its kind. He referred to that system of Examinations of which they had heard for the last few years so much, and which, he ventured to think, had done good service in promoting the instruction of the people. Though the Society had been in active operation for more than a century, it was only within the last few years that it had turned its attention to the subject of education as an essential element in the promotion of the great objects for which it was instituted. Within the last few years it had extended its operations, not only throughout London, not alone throughout the county of Middlesex, but into every county of this kingdom. The Society of Arts at the present moment, in every county in England, in the most remote corners of Scotland, and on the other side of the Channel, had numerous institutions in union with it, all of which co-operated, all of which aided it in promoting the great end of public instruction. And he thought he might venture to say that this Society in this respect was unique.

It was the only Society of its kind in Europe which had done so much: and he thought that in this respect it had set an example worthy of being followed by the other countries of Europe. He might mention, as a rather remarkable and interesting fact, that the only similar body which existed in the world as an educational body, was their own educational establishment in Hindostan. In Bengal there existed a great educational institution, which sent out its agents throughout the country, and which had throughout the presidency of Bengal its "Local Boards." It was a remarkable fact that in that portion of her Majesty's empire, the very same system of examination had been adopted. Now this system of examination was one which seemed to him, in spite of all that had been said about it for the last few years, not to have attracted one-tenth of the attention which it deserved. The Institutions throughout this kingdom had been formed by the voluntary association, he might say chiefly of working men. Some of them, it was true, admitted into their rooms men who did not wear the clothes of the workman, but as a general rule these institutions were intended for and used by the working classes. Now, everyone present knew that the great problem of education at the present day was to solve what had been called the collision between the labour market and the school. They had heard men in Parliament and many out of Parliament decrying the present state of things as one which was a disgrace to England. They were told, that instead of their schools being filled with children, the labour market was such a powerful rival to the schools, that it drew from them those who ought to be their legitimate occupants. He ventured to think that that was the best indication that could be given of two things—first, of our commercial greatness; and secondly, which was more important, of that independent spirit which he hoped we all possessed. If he thought that no educational agency existed by which this apparent defect was to be remedied he would join in an attack against that system; but he knew that the Society of Arts, through its numerous institutions, by its lectures, by its exhibitions, but, above all, by its system of examinations, was doing that which the schools had failed to do. And he thought he should prove his case by mentioning that at the examination in 1858, upon comparing the results at which the examiners had arrived, the extraordinary fact was elicited that those pupils who had attended school on an average a little over three years, had actually answered better than those who had attended school for more than six years. This being the fact—this being something that there was no denying—it demanded their attention, and the explanation of it had been given very fairly by Mr. Cowper, who some time since presided over the Educational Department of the Government. That gentleman had said that, taking this remarkable fact, it proved this—that they had in England great and powerful agents of secondary instruction. They had their Mechanics' Institutions; they had their Young Men's Associations; they had agencies of education, of which he believed this country had felt the value, and of which they ought to be justly proud. He had said that the House of Commons should remember this Society. He thought that the Chancellor of the Exchequer must look with no small interest upon their educational efforts, and on the great results they had achieved. They could tell him this, "We have educated all these young men; we have held all these Examinations, and we have not asked for one farthing of your money. We have done all this by our own efforts; and if you wish to pare down the revenue, look to and support those Institutions which are doing so much without any cost whatever to the public. Promote Societies like this—promote Institutions which are doing for England what the House of Commons has long attempted to do. Do that and you will save the public money to a large extent, as well as promote that indedependent spirit which cannot be too much encouraged." He might refer to the fact that, on this occasion, they might congratulate themselves that this year these examinations had found their way beyond the Tweed and across the Irish Channel. It was matter of no small gratifica- for any one interested in this subject to be told that the Institution which had most distinguished itself at the last examination, and which had obtained the largest number of prizes, was a Scotch Institution; and he was happy also to find that, at the last Examination, Ireland played no small part. He trusted that the public would study this system of examination, and would thoroughly understand that this great net-work of Institutions, which was now spread over the entire country, was above all things that which was worthy of support, and he hoped that this system would be constantly extending year after year, and would become more and more appreciated. He begged to give them a toast which he was sure they would drink with great pleasure, "Prosperity to the Institutions in Union with the Society of Arts."

The toast having been drunk,

The Rev. J. S. **Howson** returned thanks. He thought no man could perform this duty so efficiently as he could wish to do, after spending on that hot day between six and seven hours in a conference relating to a great variety of subjects, and taking rather an active part in that conference. They had been discussing that day such subjects as these: What arrangements can be made for securing to the poorer and smaller institutions the same advantages which the larger and richer institutions have for some time derived from their connection with this Society? Again. What advantages may be expected from the continuance of the system of the prizes which have been so munificently given for the encouragement of those young men whose studies you desire to stimulate? They had also been speaking about the museums, and collections of natural history, and works of art, with a view to the obtaining of admission for the public of an evening, and also how far small museums might be formed in the provinces, and similarly thrown open for the amusement and instruction of the humbler classes, and for the discouragement of their frequenting other places of amusement of a far less satisfactory character. They had even ventured upon the precarious ground of the question of how far Government help might be given to evening classes of the institutions in union on the same terms on which aid had been granted to the evening schools connected with inspected day schools; and, above all, they had been discussing the duties of the local boards. They had been considering how those duties had been performed, and how far they might be better performed in future. He was glad that they should be able to return to their several localities with the sanction of general approval from the Society of Arts. The duties were said to have been on the whole very well performed; and he thought he might say on behalf of the various localities that they were really desirous to co-operate with the Society in the great undertaking which it had set on foot for the Improvement of the Education of the Working Classes. He thought the mere enumeration of these subjects established a sufficient claim, on the part of the Society, to the gratitude of the Institutions in Union. He was persuaded that in originating this great system of Examinations they had conferred a very signal benefit; and if the localities were true to their duty, a very permanent benefit had been conferred upon the country at large. Mr. Hennessy had enlarged upon the importance of these examinations. The influence of examination extended more widely than many persons supposed. They all knew how wisely and well-conducted examinations stimulated talent and rewarded industry; but he was inclined to think that it very often happened that the unsuccessful candidates in a contest of this kind derived quite as much benefit as those who achieved the highest success. It was no unimportant thing for a young man, and especially for a working man, to put his knowledge into systematic shape, as he must necessarily do if he meant to submit himself to a searching and impartial test. He thought, as his lordship had observed, this was a project which was for the benefit of all: for they must not forget the social advantages which resulted from the organisation which had been established. How much interest had been thus stirred up on the part of the wealthy for the elevation of the poor—how much time had been thus devoted by those who had leisure, and by many who had very little leisure—for the encouragement of the struggling and the deserving. There was much sympathy excited and kept up between classes too apt to be discordant, and between one locality and another. All those efforts and influences were fostered by this undertaking of the Society of Arts, and he was sure he expressed the feeling of all at that table, and of many who were not present, when he said that the utmost gratitude was due to this ancient Society—to its Council, its Officers, and its Examiners—and he was sure that in the various localities of England they were desirous loyally and heartily to cooperate with the Society in improving, and elevating the education of their famous working men.

Mr. C. Wentworth Dilke said at that late hour it was not his intention to detain them for many seconds, it being then about thirteen hours since he commenced duty on that day. But there were one or two small points which he thought had been overlooked by the various speakers who had preceded him. They had naturally enlarged upon the more important duties undertaken by the Society; but there were many—a great many—other matters which it fostered, and in fostering he thought had done a great deal of good. He alluded, in the first place, to the annual Exhibition of Patented Inventions, which, during his almost daily visits to the Society, he found was visited, not merely by loungers, but by persons who took the greatest interest in such matters. Referring to other subjects of minor importance, he could not forget the outcry that was raised from one end of London to the other when the advertisement appeared inviting competition for a premium offered by the Society for a paint box, at the hitherto unprecedented price of one shilling. It was characterised as an absurdity and a folly, and he hardly knew which was to be ruined first—the Society or the trade. The result had been that boxes of excellent colours, and admirable in every sense; had been produced, not by hundreds merely, but the last return showed that the sale of those boxes amounted to 30,000 annually. Take again mathematical instruments, which had been sold in large numbers at half-a-crown per set. A still more extraordinary instance had astonished a great many men of science, who ten or twelve years ago gave as much as fifty guineas for a good microscope. The Society of Arts offered for competition a premium for a microscope which could be purchased for a small sum, and the result was the production of an instrument of great power and beauty, which could be obtained at the price of three guineas, as well as of a smaller one at half-a-guinea. Those were the points upon which they, the workers of the Society, laid great stress, as well as upon the more important subjects that had been alluded to by the preceding speakers. There had been one slight mistake made by the noble chairman. The project for the Exhibition of 1861 was not stopped. Circumstances, over which they had no control, had unhappily produced continental war; but he ventured to say that the proposed Exhibition was simply postponed. He had no hesitation in declaring that but for the war everything was prepared, and success was certain. A guarantee fund to the amount of £250,000 was so far advanced that he felt certain it would have been completed immediately after the list had been made public. Therefore, whenever peace should be happily declared, he trusted that whoever might be in power in the Society—for his term of office expired on the following day—would bring forward this movement again, and that in 1862 or 1863 they would have a Universal Exhibition, which would be equally if not more successful than that of 1851. He would now come to the pleasing duty which devolved upon him as the organ of the Council, viz., to invite them to drink to the health of the kind and noble gentleman who presided over them that evening. Indeed, he hardly knew whether a vote of thanks ought not to be passed to the Council for having obtained a Chairman who had favoured them with so admirable a speech. He called upon them to drink bumpers to the health of Lord Napier, the Chairman of the evening.

The toast was drunk with prolonged cheering.

The Chairman rose and said—Gentlemen, I return you my most sincere thanks for the honour you have conferred on me by selecting me as your Chairman, and for the flattering manner in which you have drunk my health. I believe that I have been recommended to your notice by the course which I pursued in my recent mission to the United States. I can possess no other claim to your attention or approval. I fear, gentlemen, that the results of that mission, though they have been alluded to with approbation, must appear of an unsubstantial character. There is, indeed, much in the relations of England and America which is susceptible of improvement by conventional engagements. I need not mention more than these two subjects, commercial reciprocity and international copyright. To those objects my hopes were pointed; but the time was brief, and the circumstances were not auspicious. I had first to clear the field of several miserable matters of asperity and controversy which still encumbered our relations, and to reduce the popular feelings to a cordial and friendly temper. In this preliminary labour some progress, I trust, was made; and it may be that the principles of good-will which I endeavoured to implant will bear practical fruits in the hands of my distinguished successor. Gentlemen, I left the United States certainly with no unhesitating admiration of their institutions—for I have a deep apprehension of the dangers and corruptions to which these institutions are exposed—but with a firm persuasion that in that great republic there is a deep-laid sentiment of attachment and respect for the Mother Country, which, if happily managed and kindly requited, would be productive of the most valuable results to both. I left America with a feeling of indelible gratitude for a thousand manifestations of kindness which I there experienced, and with every sympathy for those millions of our kindred working out their destinies on the greatest theatre ever abandoned by Providence to the energies of men. Gentlemen, in whatever duty I may be hereafter employed, I shall carry with me a lively sense of the kindness which I have experienced from the Society of Arts.

ANNUAL GENERAL MEETING.

Wednesday, June 29, 1859.

The Annual General Meeting for receiving the Council's Report, and the Treasurers' Statement of the Receipts, Payments, and Expenditure during the past year, and also for the Election of Officers, was held on Wednesday, the 29th inst., at 4 p.m. C. Wentworth Dilke, Esq., Chairman of Council, presided.

The Secretary having read the Bye-laws relating to the Annual General Meeting,

The Chairman, in opening the proceedings, said, that by the bye-laws, he was directed to nominate two gentlemen to act as scrutineers of the ballot for the election of officers. He would ask Messrs. Charles Brooke and John Hollingshead to undertake that office.

These gentlemen having consented to act, the

Chairman declared the ballot open. He then called upon the Secretary to read the

ANNUAL REPORT.

In accordance with the terms of the Society's Charter and Bye-laws, the Council this day retire from office, and present to the members a report of their proceedings during their year of office.

Committees.

The Gutta Percha Committee has met several times, and is carrying out systematically its experiments. The Committee have had under their consideration the properties of the substance called "Pauchontee," an Indian gum, alluded to in the Council's report of last year as the product of a tree of the same genus as that from which the true gutta percha is produced. This substance has been carefully analysed and experimented upon, and a report as to its nature and properties has been sent, as requested, to the Indian Government. For this report, and the experiments and analyses, the Society are indebted to Mr. Dugald Campbell, one of the members of the Committee. From this report it appears that at the ordinary temperature it is hard and brittle, but upon the addition of heat, such as that caused by friction in a mortar, it becomes sticky and viscid, and when once this condition is reached, it does not after the lapse of several days, assume its original consistence. When boiled with water, it becomes of a reddish brown colour, rendering the water turbid and slightly saponaceous. Experiments were made with a view to compare the properties of the gum with those of gutta percha. For this purpose, the comportment of each, when brought into contact with various chemical reagents in similar conditions, was particularly noticed, and the results are shown in a table accompanying the report. By a careful reference to the table, it may be seen that with some of the reagents, the behaviour of the gum is precisely similar to that of the gutta percha, while with others only a slight similarity is to be observed. Both seem to be nearly soluble in fuming nitric acid, while ordinary nitric acid and dilute nitric acid produce a similar reaction on both. In no one case can there be said to be a decided difference.

Further experiments were made by dissolving similar quantities of gutta percha and gum in equal portions of naphtha and turpentine respectively, and after pouring the solutions from the sediment, allowing them to evaporate at the ordinary temperature of the atmosphere. After standing to evaporate the solvent, the gutta percha in each case had returned to its original condition, while the gum was soft and sticky, except when submitted to a considerable degree of cold, when it became brittle and friable as at first.

From these results it will be seen that the gum alone could not be used for similar purposes to which gutta percha is applied.

Experiments were made in order to ascertain how far the gum could be mixed with gutta percha without interfering to any great extent with the properties of the latter, and mixtures were made containing 5, 10, 20, 30, 40, 50, 60, and 70 per cent. of the gum and gutta percha. From an examination of these mixtures it would appear, that from 20 to 30 per cent. of the gum may be added to the gutta percha without any material difference being noticed in the mixture to the gutta percha alone. But it is necessary to observe, that these mixtures have not been put to the test of sunlight, air, &c., which are known to decay gutta percha more or less, according to the nature of the gutta percha (gutta percha not being a perfectly definite substance) and the time it may be exposed, as their application may have to extend over some years before a result could be obtained of any value.

Specimens of gutta percha alone, and mixed as stated, accompanied the report, to which was appended a valuable table, shewing the results of the various experiments which have been made.

The Surgical Instrument Committee, which had just been appointed and organised at the time of the last report, has commenced its labours; and its various Sub-Committees, into which it has been divided, have prepared a complete Catalogue of the instruments and apparatus employed for the investigation and treatment of disease. This list, drawn up under the direction of the several Sub-Committees, awaits now the formal sanction of the General Committee previous to its being published. Such a Catalogue has long been wanting in the profession.

The Artistic Copyright Committee of last year having made its report, embodying the principles upon which an amendment of the Law of Copyright in Works of Art should be based, as likely to meet the requirements of the public on the one hand and of the artist on the other, it became the duty of the Council at once to endeavour to procure the passing of an Act of Parliament to secure such an amended Law of Copyright. With that view a small Committee, as an executive, over which Sir Charles Eastlake, P.R.A., consented to preside, was appointed, and numerous meetings having been held, a Bill was settled which it was hoped would have been before the Legislature during this Session of Parliament, but the unexpected dissolution of Parliament, and the consequent interruption of business, has prevented the subject from being investigated at present. The Council, however, will still use their best exertions to bring the matter before Parliament at the earliest time possible.

The Council have had under their consideration the best means of rendering the action of the Society available for obtaining and diffusing among the public of this country information in reference to the productions, resources, and capabilities of the Colonies, and with that view a Committee was appointed early in the session to take charge of the subject. That Committee commenced its labours by seeking and obtaining the aid of the Secretary of State for the Colonies to enable the Society more fully to carry out its object. Sir Edward Bulwer Lytton at once consented to give such official assistance as might be required, and, at the request of the Council, called the attention of the Governors of our Colonies to the wishes and objects of the Society as expressed in a letter addressed to Lord Carnarvon, the Under Secretary, in which the Council state that the best measures for obtaining the object in view would be—

1. That such Colonies as consider that the meetings and proceedings of the Society of Arts would at all serve to give publicity to their resources, and tend to increase the demand for their productions, should select some competent person, or existing Society in the Colony, to frame a complete statement of the points upon which it is considered that the public of the mother-country are not sufficiently informed.

2. That the individual or public body thus selected should at once be put in direct communication with the Society of Arts.

3. That the person or persons thus chosen should also designate, and obtain the consent of, some well-informed person in this country, either himself to read, at an evening meeting of the Society, the paper prepared in the colony, or to confer with the Council as to the best method of securing their common objects.

Further proceedings may be later indicated, or may arise from the steps proposed.

Should any Colony consider that a different course of proceeding would better suit the peculiar circumstances of that Colony, the Society of Arts will be quite prepared to receive such suggestions.

The result has been that several of the Colonies are already in communication with the Society, and more will, no doubt, be added to the list before the Society resumes its meetings in November next, or when a sufficient time has elapsed for replies to be received.

Exhibition of 1861.

The Council have now to refer to a subject of great importance, which, during the past year, occupied a large portion of their time—the proposed Exhibition of 1861; and to explain not only why they proposed to hold it, and what success they foresaw for it, but also why they have now postponed it.

It will be in the recollection of the members that, at the commencement of the past year, the subject of holding a Second International Exhibition was brought before the Council, and that after five meetings—each convened to consider the question—it was resolved, on the evidence that had been then obtained, as well as on the evidence published by the Society in 1849 (when resolutions favourable to the holding of Periodical Exhibitions were first passed), that Periodical Exhibitions would be of benefit to Arts, Manufactures, and Commerce, and ultimately the following resolutions were published by our predecessors in office:—

> The Council of the Society of Arts, bearing in mind the part which the Society took in originating the Great Exhibition of 1851, have considered it to be their duty carefully to examine various suggestions for holding an Exhibition in 1861, which have been submitted to them, and have resolved:—
>
> 1. That the institution of Decennial Exhibitions in London for the purpose of showing the progress made in Industry and Art during each period of ten years, would tend greatly to the "Encouragement of Arts, Manufactures and Commerce."
>
> 2. That the first of these Exhibitions ought not to be a repetition of the Exhibition of 1851, which must be considered an exceptional event, but should be an Exhibition of works selected for excellence, illustrating especially the progress of Industry and Art, and arranged according to classes, and not countries; and that it should comprehend Music and also Painting, which was excluded in 1851.
>
> 3. That Foreigners should be invited to exhibit on the same conditions as British Exhibitors.
>
> 4. That the Council will proceed to consider how the foregoing resolutions can be best carried into effect.
>
> P. LE NEVE FOSTER, *Secretary.*

The time consumed in inquiries and discussions had brought the Council so near to the close of their official powers, that all further proceedings necessarily devolved upon their successors.

Early in the following session the subject was brought before the new Council, and this body concurring in the views of their predecessors, resolved that, considering all the circumstances, it appeared desirable to entrust the government of the proposed Exhibition to the Commissioners of 1851. The following letter was therefore, early in December, addressed to her Majesty's Commissioners:—

> Sir,—I am instructed by the Council of the Society of Arts to request you to call the attention of her Majesty's Commissioners for the Exhibition of 1851 to the fact that, in February last, the subject of holding a Second International Exhibition of Industry was brought before the Council of the Society of Arts, and that, after five meetings, each specially summoned to consider the subject, and each fully attended, the following resolutions, based on such information as the Council could obtain, were passed. (See resolutions above.)
>
> The Council, after arriving at these conclusions, considered that as more than three years had to elapse before the date of the contemplated Exhibition, it would be well to put forth the resolutions at once, in order that the opinions of the commercial public at large might be the better ascertained. They were accordingly published in April last.
>
> The newly-elected Council of the Society, at their third

meeting in November, having in the interim learnt the feeling of increased numbers of the commercial world, have confirmed the views of their predecessors in office, and further resolved that it would be proper to address themselves to her Majesty's Commissioners who conducted the Exhibition of 1851.

In accordance with this resolution, I am instructed to ask you to bring the subject before her Majesty's Commissioners, and to inform me whether they would be willing to entertain the question of undertaking the management of the Exhibition of 1861.

The Council feel it unnecessary to give any detailed reasons for submitting this application, for it will be obvious that the great success which attended the labours of her Majesty's Commissioners in 1851, and their announcements, when soliciting Public Subscriptions on behalf of the Exhibition, make this application one of the greatest propriety. In the event of her Majesty's Commissioners being prepared to act, I am directed by the Council of the Society of Arts to say they are prepared, as in 1851, to render any assistance in their power to them.

I am, &c.,
(Signed) P. LE NEVE FOSTER, *Secretary.*

Edgar A. Bowring, Esq.,
Secretary to the Commissioners for the Exhibition of 1851.

Her Majesty's Commissioners did not meet until the 19th of February, and the following was the reply to the application of the Council:—

Palace of Westminster, 19th February, 1859.

SIR,—I am directed by Her Majesty's Commissioners for the Exhibition of 1851, to acknowledge the receipt of your letter, transmitting a copy of certain Resolutions passed by the Council of the Society of Arts, on the subject of a proposed International Exhibition to be held in London, in 1861, and inquiring, on behalf of the Council, whether the Commissioners will be willing to entertain the question of themselves undertaking the management of such an Exhibition.

In reply, I am directed to state, for the information of the Council of the Society of Arts, that Her Majesty's Commissioners consider that they could only be justified in complying with this request upon its being made to appear to them, not only that the scheme of the proposed Exhibition meets with the general sympathy and support of the public to an extent sufficient to warrant a reasonable confidence of success, but also that the necessary funds would be at once forthcoming for the purpose of defraying the expenses of the Exhibition until those expenses are met by the receipts derivable from it.

The Society of Arts are aware that the Commissioners have themselves no funds at their disposal applicable to the purposes of the proposed Exhibition, nor have the Commissioners, at the present moment, any information before them on which to found an opinion as to the amount of public support that may be anticipated for the undertaking. In the absence of this information they do not consider themselves in a position to return a positive answer to the inquiry contained in your letter.

Upon being made acquainted with the result of any enquiries on this subject which may be instituted by the Society of Arts, it will give Her Majesty's Commissioners much pleasure to proceed to consider (should that result prove satisfactory) how far it may be in their power to contribute to the success of the Exhibition, and also to determine the position to be taken by them with respect to its management.

I am &c.,
(Signed) EDGAR A. BOWRING.
Secretary.

P. Le Neve Foster, Esq.,
Secretary, Society of Arts.

It will be seen that in this answer stress was laid on two points: first that it was the duty of the Council to satisfy her Majesty's Commissioners that exhibitors were anxious for such an Exhibition; and, secondly, that it was the duty of the Society of Arts to furnish the Commissioners with a guarantee for the entire expenditure. The Council, after full consideration of these points, came to a conclusion different from that of the Commissioners. That such an Exhibition would meet with general sympathy and support, they considered as solved by the results of the Exhibition of 1851, which was announced as the first of a series of Quinquennial Exhibitions; and they felt that if any doubts had subsequently arisen, as might be inferred from the reply of the Commissioners, it would be better for the Commissioners to make such further inquiries as they might deem necessary; and that, in reference to the guarantee fund, it was the province of the Commissioners to initiate it—the Commissioners having, eight years before, received, as the profitable result of the Exhibition of 1851, two hundred thousand pounds, seventy thousand of which had been contributed by the public as a subscription after it had been declared, in February, 1850, that any surplus should be applied "to purposes strictly in connection with the ends of the Exhibition, or for the establishment of similar Exhibitions for the future." The following reply was, therefore, forwarded:—

11th March, 1859.

SIR,—The Council of the Society for the Encouragement of Arts, Manufactures, and Commerce has carefully considered your letter of the 19th February, 1859.

With much satisfaction the Council perceives that her Majesty's Commissioners raise no question as to the beneficial effects of the intended International Exhibition in 1861; but lay down the important conditions that, before they can decide how far it may be in their power to contribute to the success of the Exhibition, and what position they can take in respect of its management, they must be satisfied that it will receive sufficient support, and that means to meet the expenditure will be at once forthcoming.

On both of these points the Council will have much pleasure in doing all in its power to satisfy and to aid the Commissioners.

Looking upon the intended Exhibition as a stimulus to the development of the industrial resources of the country, and to the advancement of science and the arts, the Council is aware that, while H.M. Commissioners cannot take a mere financial view of the undertaking (as if the expectation of pecuniary profits could alone induce them to embark in it), they must not be exposed to a large pecuniary risk or to any serious failure.

To provide means for meeting the expenditure, the Council proposes that a guarantee fund of £250,000 should at once be subscribed for; and it is presumed the Commissioners will regard such a subscription as a sufficient test of the probability of success. To enable the Council, however, to obtain this guarantee, the previous co-operation of the Royal Commissioners appears at present to be indispensable. To make this clear, it is necessary to explain in some detail the position and views of the Society of Arts.

H.M. Commissioners are aware that H.R.H. the President of the Society of Arts, and the other members of the Society, who were the originators of the Great Exhibition of 1851, never contemplated that it should be the last as well as the first International Exhibition of Industry. The beneficial effects of periodical exhibitions in painting, agriculture, and horticulture having been proved, it could not have been intended to do no more for general industry than to hold one Industrial Exhibition without successors; and, accordingly, in the letter addressed in 1849, on behalf of the Society of Arts, to H.M. Principal Secretary of State, by H.R.H., the President, applying for the appointment of Royal Commissioners to manage the Exhibition of 1851, it was expressly stated that the Society's object was that quinquennial Exhibitions of Industry should be established. The Society was well aware that any beneficial results which the Exhibition of 1851 might accomplish, could only be fully known when the condition of general industry should be again tested, after a proper interval, by a similar Exhibition; and that, if none such should be held, the good effects of the Exhibition of 1851 would subside and evil would ensue, the stamp of authority having been so fixed by the jurors of 1851 on past improvements as even to create an obstacle to further improvements.

Early in 1858, the Council received suggestions that it was the duty of the Society of Arts to renew the action by which the Society originated the Exhibition of 1851, and to originate a new Exhibition in 1861. The subject was carefully considered by the Council; and the results of its repeated deliberations were expressed in the resolutions which have been submitted to the Royal Commissioners.

Having re-affirmed the conclusions arrived at and published in 1849, that the interests of arts, manufactures, and commerce require international Exhibitions of Industry to be held periodically; and considering, with the experience obtained in 1851, that decennial periods would be more expedient, the Council announced the Exhibition of 1861, in the full conviction that, when it should be satisfactorily settled where, and under what management, the Exhibition was to be held, a guarantee for the expenditure would be easily obtained, as in 1849, and the requisite support would certainly ensue.

The Council, however, has been constantly met by inquiries, on the part of the public, whether the Exhibition will be held at South Kensington, on the land purchased by H.M. Commissioners; whether the Commissioners will manage the Exhibition; and what part they will take in guaranteeing the requisite funds. The public refer to the Royal Commission as appointed, and continued in existence, by her Majesty for purposes strictly analogous to those of the Exhibition now intended, and as having exclusive control, for those purposes, over the large property which has been created with the proceeds of the previous Exhibition; and it will be very difficult indeed to obtain a satisfactory list of guaranteers, until replies have been given to those inquiries. If H.M. Commissioners will place the name of the Royal Commission at the head of the list of guaranteers, the Council will immediately proceed to complete it.

The Council, though not hitherto in a position to determine absolutely the success of the Exhibition, has done enough by inquiries to satisfy itself that the Exhibition of 1861, managed with the same spirit and intelligence as its great predecessor in 1851, will elicit still more definite and valuable results.

The Council submits to H.M. Commissioners the following general considerations.

Since 1851, commerce has been so extensively developed, not only at home and with the colonies, but with foreign countries, that a knowledge of the productions of other nations has become everywhere a necessary part of mercantile education. In manufactures there have been numberless inventions and improvements. Population and wealth have greatly increased. In the Metropolis alone, in 1861, 500,000 persons will have been added to the population, and 700,000 young persons of 1851 will have become adults. The means and popular habits of locomotion have been immensely extended at home and abroad. In England, the railways have already increased from 6,000 miles in 1851 to 9,000 in 1858; and the railway travellers from 85,000,000 in 1851 to 148,000,000 in 1858. On the continent the increase has been far greater. The desire to see, and, by seeing, to attain knowledge, coupled with the love of art, has received an extraordinary stimulus in all civilised countries. The same influences will be at work in 1861 as in 1851 to induce manufacturers and inventors to exhibit their productions. Those who are insufficiently known, young and enterprising, will be foremost to meet the competition. Those who are better known and established will not be left behind.

Much will depend on the selection of the site, and on the authority in which the management of the Exhibition is vested. To give proper confidence to guaranteers and exhibitors, the undertaking should have a national character, and be carried on under the countenance, if not under the immediate direction, of a constituted authority.

The Council expresses its conviction that, if H.M. Commissioners join in the guarantee, and allow it to be announced that, provided it be completed by a given day, they will hold the Exhibition of 1861 on their own ground at South Kensington, the elements of success will be such that failure will be almost impossible; and the Council feels sure that H.M. Commissioners may have at least as much confidence in the public spirit and intelligence of all classes of the community in 1859 as they had in 1849.

I am, Sir,
Your obedient servant,
P. LE NEVE FOSTER, Secretary.

Edgar A. Bowring, Esq.,
Secretary to the Commissioners for the Exhibition of 1851.

It will be observed that, though the Council thought it not becoming in the Society to institute the Guarantee Fund, the Council offered, if the Commissioners would initiate it, to undertake *to complete it.* To that letter the Council have not received a reply, and they have not pressed for one, because at this stage of the negociation the probabilities of a war between some of the great European States were strengthening, and had raised a question for grave consideration—whether the Exhibition of 1861 ought not to be deferred; and the Council hoped that by postponing action for a short time the aspect of foreign affairs would be so far declared as to leave the Society in a position to judge better what ought to be their future course. The Council therefore, whilst awaiting the issue, ceased to press forward the subject. But though the Council have not received a reply, it is due to the Commission to state that several members of that body have, it is understood, intimated their impression that it would be a proper act on the part of the Commission to affix their seal to such guarantee.

The Council have no doubt that the requisite Guarantee Fund would have been easily obtained. Indeed, no sooner was the subject suggested, than considerable sums were offered. Mr. Matthew Uzielli offered to guarantee £10,000; and some of the members of the Council and their friends authorised the Chairman of Council (a member of the Commission of 1851)—should the Royal Commissioners, at their next meeting, decide on heading the guarantee—at once to append the names of various gentlemen for the sum of £73,000.

Further, the Chairman was authorised to announce to the Commissioners that the directors of one public company had passed a resolution, inviting their shareholders to authorise them to subscribe to the guarantee; that the directors of the railways having stations in London had decided not only to offer every facility for the Exhibition, but the directors of one of the largest companies had passed a resolution recommending their shareholders themselves to take part in the guarantee, and the Chairman of Council had been invited to meet the chairmen of the different Boards at a joint meeting, to consider the subject of the guarantee generally. Here it is due to the Marquis of Chandos to express the deep sense the Council feel of the interest his lordship has taken in the subject. It is also highly gratifying to state that, though no formal communication has been made to the Council, the Chairman was privately informed that it was the intention of His Royal Highness the President both of the Society of Arts and of the Commission, to affix his signature to the guarantee; and that the Marquis of Salisbury and Lord Granville intended also to take part in it. The Council have, moreover, reason to believe that a large number of the members of the Society would have been prepared to join so soon as the subject was brought before them; indeed, the Council have no doubt that had an appeal been made to the public, the full guarantee would have been secured within a few days.

A marked difference appears between the names of the supposed guarantors on this and on the occasion of 1851. They now consist principally of persons especially interested in such Exhibitions, and who can best appreciate their importance, value, and influence on Arts, Manufactures, and Commerce.

Reverting to the second point—the question of satisfying the Commissioners as to the want of such an Exhibition—the Council felt that, though it was their duty to aid the Commissioners by making on this occasion, as they did at the time of the former Exhibition, all the preliminary arrangements, yet it would be more appropriate for the Commission itself to undertake such further inquiry as they might think necessary, or, at least, to indicate precisely what they required. But, though the Council hesitated to undertake a general canvass without previous expression of opinion from the Commission, they authorized their Chairman to place in the hands of H.R.H. the President, whenever a meeting of the Commission should be held, the evidence they had obtained. Amongst such proofs would have been the following:—

The Council, feeling that without full support from certain classes of Exhibitors, especially those connected with the Fine Arts, a great void would be perceived in the Exhibition of 1861, determined to ascertain the opinions of those who would exhibit in Class 10, and also of the sculptors in general. They therefore caused a communication to be made to these two classes, and they had the satisfaction to find that they would be supported by every sculptor residing in London, and that amongst Goldsmiths, Watchmakers, Opticians, Mathematical Instrument Makers, and Musical Instrument Makers, forming Class 10, in the metropolis alone they might count on above 300 Exhibitors. They further ascertained that in Birmingham the leaders of the principal trades were prepared to take part in it. Here was evidence sufficient, it was considered, to justify the Council; but representatives of other classes furnished their contingent and affixed their names as intending Exhibitors; and many foreign Exhibitors, contributors to the Exhibition of 1851, and to that in Paris in 1855, intimated their intention of forwarding specimens of their productions. It was, therefore, with deep regret that the Council saw the political horizon becoming darker and darker still. They felt that, should war be unhappily declared, an International Exhibition could not be held with any reasonable chance of success. At last the actual movement of troops made it necessary to specially consider the subject; and, after meetings held on the 4th and 18th of May, the Council passed the following resolutions:—

> That with reference to the present and prospective condition of the Continent, the Council is of opinion that the International Exhibition proposed to be held in 1861 should be postponed to a more favourable opportunity.
>
> That this resolution be communicated to his Royal Highness the President of the Society, and to her Majesty's Commissioners for the Great Exhibition of 1851.
>
> That the Chairman be requested to prepare a report of the proceedings which have been taken by the Council to ensure the success of the intended International Exhibition of 1861, together with an explanation of the grounds on which the Council has come to the conclusion that the Exhibition should be postponed to a more favourable opportunity.
>
> That the Chairman's statement form part of the Annual Report to be laid before the Annual General Meeting on the 29th June next.

These resolutions have been communicated to H.R.H. the President of the Society, and to her Majesty's Commissioners. It was not without long consideration, and even a slight difference of opinion in the Council, that these resolutions were carried. It was felt by some members that it was the duty of the Society, as a body independent of politics, to enter a protest against war being allowed to interfere further than is inevitable with Arts, Manufactures, and Commerce, interrupting thereby the progress of civilisation; and it was urged—and well urged—that, even assuming war to continue, England alone could produce an Exhibition worthy of public patronage. The majority of the Council, however, felt that the public mind was never occupied by two great subjects at once, and that even a partial failure would be more prejudicial to future Exhibitions than a postponement, and they therefore, though with deep regret, passed the resolutions already read.—The next great International Exhibition stands, therefore, postponed until the earliest favourable opportunity.

UNIFORM MUSICAL PITCH.

The Council of the Society of Arts having had brought under their consideration the question of the alteration of the musical pitch by the French Government, and how far such alteration was likely to affect musical performances in England, the Chairman of Council consulted some of the leading musical authorities, and it appearing to be the nearly general wish that a discussion on the subject should take place, the Council invited a considerable number of the principal scientific and musical authorities interested in the question to meet at the Society's house. The meeting was well attended. The Rev. Dr. Whewell presided, and a resolution was unanimously passed by the meeting affirming the desirability of a uniform musical pitch, and a Committee has been formed to consider and report what pitch should be adopted.

EXHIBITION OF INVENTIONS.

The Society has held its Eleventh Annual Exhibition of Inventions, to which a largely increased number of articles has been contributed. It has been visited by between six and seven thousand individuals, a larger number than on any previous occasion.

CONVERSAZIONI.

Two Conversazioni have been held, one in the Society's House, and one, to which ladies were invited, at the Museum at South Kensington; the latter was attended by 2,800 persons.

MEDALS.

The Council, on the recommendation of the Committees, have awarded the following Medals:—

To Messrs. Hamilton and Nash, for an "Improved Lock." *The Society's Silver Medal.*

To Messrs. Peter and Charles Garnett, for their "Toothed-Roller Cotton Gin." *The Society's Silver Medal.*

To Mr. F. Joubert for his invention of "A Method of rendering Engraved Copper Plates capable of producing a greatly increased number of impressions," and for his paper explanatory of it, read before the Society. *The Society's Silver Medal.*

To Mr. E. J. Reed, for his paper read before the Society—"On the Modification which the Ships of the Royal Navy have undergone during the Present Century in respect of Dimensions, Form, Means of Propulsion, and Powers of Attack and Defence." *The Society's Silver Medal.*

To Monsieur Théophile Silvestre, for his paper read before the Society—"Les Arts, les Artistes, et L'Industrie en Angleterre, depuis la Dernière Moitié du Dix-Huitième Siècle Jusqu'à ce Jour." *The Society's Silver Medal.*

To Dr. J. Forbes Watson, F.R.S., for his paper read before the Society:—"On the Growth of Cotton in India, its Present State and Future Prospects, with Special Reference to Supplies to Britain." *The Society's Silver Medal.*

To Mr. Leonard Wray, for his paper read before the Society:—"The Culture and Preparation of Cotton in the United States of America, &c." *The Society's Silver Medal.*

To Mr. John Bell, for his paper, read before the Society—"Some remarks on the application of Definite Proportions and the Conic Sections to Architecture, illustrated chiefly by the Obelisk, with some History of that feature of Art." *The Society's Silver Medal.*

SWINEY PRIZE.

This year brought with it the third quinquennial anniversary of the death of Dr. Swiney, and the Society, in accordance with the trust imposed on them by the will of that gentleman, have presented the Silver Goblet, of the value of £100, with the gold coin in it, to the same amount, to Dr. Alfred Swayne Taylor, F.R.S., as the author of a treatise on Medical Jurisprudence. The goblet is in silver, from a design by Mr. Maclise, and was awarded at a joint meeting of the Members of the Society of Arts and the College of Physicians, held in accordance with the terms of Dr. Swiney's will, on the 20th of January last.

WRITING CASE.

It will be remembered that in the report of last year it was stated that the sum of £20, placed in the hands of the Council by the Rev. F. Trench and J. MacGregor, Esq., to which the Council added the Society's Medal, as a Prize for a Writing Case suited for the use of soldiers, sailors, emigrants, &c., had not been awarded, none of the articles forwarded having been considered to possess sufficient merit to justify a decision in their favour. The Council then announced their attention to invite a further competition. In reply to this announcement twenty-eight cases were sent in, and, after a careful examination by the Committee, they reported in favour of a case manufactured by Messrs. Parkins and Gotto, and the Council have thereupon awarded the Prize of £20 and the Society's Silver Medal to that firm. The retail price of the case is 1s. 6d., including an indelible pencil, but without other contents, which must depend on the selection of the buyer.

FINANCIAL ESSAY.

At the date of the Council's last report, the essays sent in competition for the prize of two hundred guineas, placed in the hands of the Council by Mr. Henry Johnson, to be awarded as a prize for

"The best Essay on the present financial position of the country as affected by recent events, in which the principle of a sinking fund should be discussed, and also an investigation made as to the best mode of gradually liquidating the National Debt," were under consideration, twenty-two essays having been received. The prize has since been adjudged to Mr. Edward Capps, and the essay has been published. The adjudicators appointed by the Society to report on the merits of these essays were Professor Charles Neate, of Oxford, Professor Waley, of University College, London, and Mr. J. T. Danson, Fellow of the Statistical Society, and their decision in favour of Mr. Capps was unanimous.

Marine Algæ.

The Council in their last report informed the members that no Essays had been sent in to compete for the two prizes of £50 and £20, placed in their hands by Sir W. C. Trevelyan, Bart. That gentleman has now increased the amount to £100, and that sum is now at the disposal of the Council as a single Prize for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on sea-weeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be delivered at the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which must also be written on a sealed letter containing the name and address of the author.

Union of Institutions.

For the proceedings of this department of our Society, the members are referred to the Secretary's report, read to the meeting of the Representatives in Conference yesterday, published in the present number of the *Journal*, p. 543. In that report will also be found an account of the action which the Society has taken during the past year in reference to the opening of Museums and Galleries of Art in the evening.

Finances.

The annual statement of the Society's financial position, which has been already published in the Society's *Journal* of last week (See p. 531), according to the provisions of the Bye-laws, forms part of this report.

This statement shows the very satisfactory state of the Society; the annual revenue being in excess of the expenditure by £138 12s. 4d. The liabilities are also less by £300 than this time last year. The subscriptions received this year have been in excess of those of last year by £200, and the balance in the hands of the bankers available for current expenditure, is slightly larger than that of last year. Since the resuscitation of the Society, no Council have been in a position to place so satisfactory a balance-sheet before the members; while, however, the Society may congratulate itself on the prosperous state of its finances, the members must be reminded that the lease of the present premises has but eight years to run, and the new Council will have to take into their serious and immediate consideration the steps necessary to be taken for providing new premises for the Society's use, at the expiration of that period.

The amount received in aid of the Prize Fund for the successful Candidates at the Examinations has been less than in former years, and the question how far the system of giving Prizes in addition to the Certificates is beneficial, was brought before the Institutions at the Annual Conference, yesterday.

The Chairman called attention to that part of the report which mentioned the short term still remaining unexpired of the Society's lease, and was happy to inform them that the Council had received communications which led them to hope that no difficulty would arise in renewing the lease, supposing it to be decided, after careful consideration, that such a course would be beneficial to the interests of the Society.

Mr. Charles Brooke, F.R.S., moved the adoption of the report, which was seconded by Dr. Chowne, and carried unanimously.

Mr. Winkworth, Vice. Pres., proposed the following resolution:—

> "That the cordial thanks of the Society be tendered to Mr. C. Wentworth Dilke, Chairman of the Council, for the efficient and valuable services he has rendered to the Society during the past year."

Mr. Winkworth said that, as one of the oldest members of the Society, and one who had served many years in the Council, he had had unusual opportunities of observing the manner in which the various gentlemen who had preceded their present chairman had fulfilled the duties of that office, and he could not but say that, without any disparagement to any of them, he had never seen the office so efficiently filled, or so much energy and intelligence brought to bear upon its arduous duties as had been displayed by Mr. Dilke during his term of office. Under these circumstances, he felt peculiar pleasure in proposing the resolution he had just read.

Mr. William Hawes begged cordially to second Mr. Winkworth's resolution. The Society had had the advantage for nearly two years of Mr. Dilke's invaluable services, and he only regretted that the bye-laws of the Society precluded his re-election. The singular activity and skill he had shown in promoting the extension of the Society's sphere of operations, combined with the remarkable urbanity and courtesy with which he had presided over their meetings, had earned for him the sincere regard of his colleagues, and entitled him to the lasting gratitude of every member of the Society. He could not but feel that the Council would have great difficulty in the selection of his successor, particularly when he remembered the numerous important subjects which would occupy their attention during the ensuing Session. With reference to the question of the Great International Exhibition, Mr. Dilke's services had been of the utmost value, and when the subject should again be brought forward, which he trusted would be at no distant date, he hoped to see him reinstated in his present office. For his own part he regretted the decision of the Council as to the proposed Exhibition, for he felt strongly that it was England's duty to utter her protest against war being allowed to interfere more than was absolutely necessary with the purposes of industry and commerce. He thought England should have shown to the world what a noble Exhibition might have been brought together, even without the aid of those nations who chose to waste their energies in warfare and destruction. He begged cordially to second the vote of thanks which had been proposed.

Mr. Brown, who had represented the Lewes Institution at the recent Conference, wished to bear his testimony to the courtesy which Mr. Dilke had shown on every occasion when members of the Institutions in Union had been brought into contact with him, particularly at the Conversazione at the South Kensington Museum.

The resolution was then put by Mr. Winkworth to the meeting, and carried unanimously.

The Chairman expressed the gratification which the vote of thanks had afforded him, and intimated his willingness at all times to serve the Society, either as a member of any of its Committees, or in any other way in which he could be found useful.

Mr. R. Williams moved a cordial vote of thanks to the Council for their services during the past year.

This having been seconded by Mr. W. C. Dutton, was carried unanimously.

Mr. Hawes was about to move a vote of thanks to the officers for their services, when it was intimated to him by the Secretary that this course was contrary to custom. Mr. Hawes said that, under these circumstances, he did not desire to establish a precedent, but he might, at the same time, be allowed to express the satisfaction which it had given the Council to observe the cordiality with which the officers had worked together, and the devotion which they had all shown to the service of the Society.

The ballot having remained open one hour, and the scrutineers having reported, the Chairman declared that the following noblemen and gentlemen had been unanimously elected to fill the several offices. The names in *italics* are those of members who have not, during the past year, filled the offices to which they have been elected.

COUNCIL.

PRESIDENT.

H.R.H. The Prince Consort, K.G., F.R.S., &c., &c.

VICE-PRESIDENTS.

Thomas Dyke Acland.
Lord Ashburton, F.R.S.
W. H. Bodkin.
Harry Chester.
Henry Cole, C.B.
Frank Crossley, M.P.
C. Wentworth Dilke.
John Dillon.
William Fairbairn, F.R.S.
Thomas Graham, F.R.S. Master of the Mint.
The Earl Granville, K.G., F.R.S.
Henry Thomas Hope.
The Marquis of Lansdowne.
John Scott Russell, F.R.S.
Lord Stanley, M.P.
Robert Stephenson, M.P., F.R.S.
William Tooke, F.R.S.
Thomas Twining, Jun.
Matthew Uzielli.
Thomas Winkworth.

OTHER MEMBERS OF COUNCIL.

Charles Bagnall.
John Bell.
Thomas King Chambers, M.D.
Frank Chance, M.D.
J. Griffith Frith.
John MacGregor.
William Hawes.
Lieut.-Colonel H. Cunliffe Owen, R.E., C.B.
Sir Thomas Phillips, F.G.S.
F. R. Sandford.
Thomas Sopwith, F.R.S.
George Fergusson Wilson, F.R.S.

TREASURERS.

Peter Graham.
William Mackrell.

AUDITORS.

Arthur Lewis.
Samuel Redgrave.

SECRETARY.

Peter Le Neve Foster, M.A.

FINANCIAL OFFICER.

Samuel Thomas Davenport.

At the conclusion of the General Meeting, a Special Meeting, called for the election of members, was held, at which C. Wentworth Dilke, Esq., Chairman of the Council, presided.

The following gentlemen were balloted for and duly elected members of the Society :—

Baker, William
Bartlett, William E.
Brown, Capt. John H., R.N.
Cox, Rev. John Edward
Cox, Thomas
Cox, William
Crookes, Septimus
Davison, Frederick
Faulding, Joseph
Freake, C. J.
Gotto, Henry
Grantham, John
Hart, Herbert William
Holden, Edward
Hullah, John
Hunt, A.
Keeling, Edward Henry
Logie, Cosmo Gordon, M.D.
Loysel, Edward
Matthews, James
Napier, Rt. Hon. Lord
Parkins, William
Price, Arthur
Ransome, Frederick
Robinson, Rev. W. Woolhouse
Smith, Archibald
Sowerby, William
Tapling, Thomas
Wainwright, Henry
Warne, William
Watts, J. J.
Williams, Charles J., B.D., M.A.

HOW MUCH ART SHOULD SCHOOL CHILDREN BE TAUGHT?

A lecture on this subject, on Saturday last, the 11th instant, in the theatre of the South Kensington Museum, was delivered by Dr. G. K. Kinkel, formerly Professor of the History of Art and Civilisation in the University of Bonn. After ably and wittily pointing out the defects of the modern system of attempting to teach drawings from paper patterns, by which many pupils (girls especially) become very successful pattern tracers without acquiring any real knowledge of or love for art, Dr. Kinkel proceeded to unfold, in a few plain, terse, and energetic sentences, the first principles of art study. The plan to be pursued must be to copy from nature, no matter how blotched and scarred the first effort of the pupil. By following this, the only true system, he carries the impression of his work in his soul. It is true that the labour of teaching upon this system is much greater, but the results are incomparably more valuable. Referring more particularly to the audience he was addressing, Dr. Kinkel said they must not forget that their object was not merely to instruct children, but, in so doing, to raise up a class of art workmen. And here, he observed, that strict as was the course of study in the department of practical art enjoined by the Council, he trusted that they would not relax a particle of their rigidity. The pupils must spend so many months upon outline, then advance to shading, next drawing from casts, and finally from nature.

The lecturer made some forcible remarks *à propos* to this subject, upon *dilettanti* students, who, he observed, were generally disgusted with the imposed course of three months' outline drawing and three months' flat washing; their labour in this pursuit, as in most others, however, to be successful must be great and unceasing.

As drawing is now taught from paper patterns, and on the old routine system, a certain dexterity of copying is attained without any love of art, precisely in the same way as young ladies are taught to fire off their "six pieces" of music, to show the progress they have made in that sister art. The result in afterlife is similar, the music pupil never opens her piano, while the drawing student, among the varied scenes to which her life may throw her, never commits the likeness of one of them to paper. It should always be remembered that drawing is a practice more than a science. Do away with paper patterns altogether, but let your young pupils carefully observe the way in which you, the teacher, reduce certain forms; when a figure is seen to rise under the hand of a master, it has a far greater effect than when a pattern drawing is set before the student. The power of imitation, in a greater or less degree, is innate in all human beings, and a knowledge of the elements of proportion is valuable in every walk of life.

In village schools art-teaching should be simple but practical. Teach the pupil to reduce an object in nature to outline, then to shade his drawing. If children are taught in this way they will delight to practise as an amusement, and the love of art will be firmly implanted in their bosoms. The girl will sketch the infant sister she is nursing, and the boy will draw the portrait of his pet cow or donkey, and these familiar objects will give greater delight in their family circle than the best copy of the finest Greek model. This is exactly what the boy Giotto was doing when the great painter found him in the fields—sketching a living lamb with a piece of charcoal. The great collections of art wonders, which in Italy and Belgium are accessible to all, must be replaced in this country by directing the study of the village boy (deprived of the opportunity of visiting the splendid collections of England) to the great fountain-head of art, the contemplation of nature. If ever England is to enjoy the privilege of being an artistic nation in the sense that Italy once was, when every common piece of furniture, every pot and pitcher, was fashioned by the rules of faultless taste—if beauty is ever to bless England with her crowns superadded to those of wealth and might—it will be due to the judicious teaching of art in her simple village schools.

VEGETABLE LEATHERS.

The *Mechanics' Magazine* gives the following account of what is being done in this direction:—

"Having seen some specimens of these leathers, as well as various articles of utility manufactured therewith, we have been induced to pay the extensive works of Messrs. Spill and Co., the eminent Government contractors on Stepney-green, a visit, in order to cull sufficient to place upon record the present position of artificial as a substitute for real leather. The face and general character of the vegetable leather resembles the natural product so closely that it is only by actual examination that the difference can be determined. This is more particularly the case in that description which is made for book-binding, the covering of library tables, and like purposes. Amongst other advantages it possesses over leather proper, may be mentioned, that however thin the imitation is, it will not tear without considerable force is exercised, that it resists all damp, and that moisture may be left upon it for any period without injury, consequently, it does not sodden or cockle, is always dry, and its polish is rather increased then diminished by friction. Add to these facts that any attempt to scratch or raise its surface with the nail, or by contact with any ordinary substance, will not abrade it, and enough will have been said to justify its entering the list against an article of daily use, which has of late years been deemed far from sufficient for the demand, and has consequently risen in price to the manifest loss and injury of every class of the community. We believe that the largest entire piece of real leather that can be cut from a bullock's hide is not more than seven feet by five, and this includes the stomach and other inferior parts. Vegetable leather, on the contrary, is now produced 50 yards in length and 1½ yards wide, every portion being of equal and of any required thickness, and the smallest portion is convertible. We were agreeably disappointed, however, to find that instead of vegetable leather being a discovery requiring the aid of ourselves and contemporaries, it was, although so young, an active agent in the fabrication of numerous articles of daily requirement, and that it had already become the subject of large—indeed, we may say enormous—contracts. Caoutchouc and naphtha are used in its manufacture, but by a process known to the senior of the firm, who is himself an accomplished chemist, all odour is removed from the naphtha, and the smell of vegetable leather is rendered thereby less in strength, if anything, than that of leather. The principal objects to which it is at present applied, although it is obvious it will take a wider range of usefulness than leather itself, are carriage and horse aprons, antigropole, soldiers' belts, buckets which pack flat, harness of every description, book-binding, &c. For the latter, its toughness, washable quality, and resistance to stains render it remarkably fitted. Its thickness, which may be carried to any extent, is obtained by additional backings of linen, &c., cemented with the caoutchouc, and its strength is something marvellous, while in the all-important commercial view, it is but one-third the price of leather. Many of the articles we are shown possessed the appearance of much elegance and finish; but it was curious to observe that although most of these could be made without a stitch, and within the factory itself, a deference to the feelings of the workmen in the several trades has been shown by the firm, and the material is given out as ordinary leather to undergo the process of the needle, which it submits to with a greater facility than its original prototype. Perhaps this concession upon the part of the discoverers is both wise and politic, inasmuch as their object is more to manufacture and supply the article in the gross to the saddler, &c., than to make it up on their own premises—a monopoly which might become exceedingly formidable and injurious. We think we have glanced, although hastily, at the principal features of this important discovery, and said quite sufficient to raise the curiosity of all interested in the advance and consequent cheapening of our manufactures."

Home Correspondence.

RELATIVE VALUES OF COAL AND COKE.

Sir,—I leave it to your readers to decide whether there was anything in my letter which appeared in the *Journal* of June 3, to warrant the tone of Mr. Dugald Campbell's letter in the *Journal* of June 10; but, on the part of the non-professional members of the Society, I protest against Mr. Campbell's doctrine that anonymous reviews or comments upon scientific statements openly made should not be allowed. I submit that facts and arguments, and not persons, are the proper subjects of a scientific discussion, and that the true and only rule upon which to act is that all letters, whether anonymous or not, should be allowed a place in the *Journal* which appear to the Secretary to treat any subject which may happen to be under discussion in a fair and proper spirit, while, on the other hand, no letters, whether intended to appear with the writer's signature or anonymously, should be admitted, if they appear to the secretary to be couched in such terms as to be likely to give just cause of offence to any member of the Society. Such, I understand, has been the rule hitherto, and I submit that it should continue to be the rule till some good reason be shown to the contrary.

I.

Edinburgh, June 23.

Proceedings of Institutions.

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NOTTINGHAM MECHANICS' INSTITUTION.—The twenty-first annual report of this Institution speaks of indications of steady progression. Notwithstanding the continued unfavourable state of our staple trades, and the large number of persons who are thereby thrown out of employment, there is an increase of members and a diminution of debt—two circumstances which, it is reasonable to suppose, will not be without their proper influence on the minds of those who may be desirous of connecting themselves with the Institution. The alterations made in the library, by which members have unrestricted access to the books, appear to have given general satisfaction. The following statement exhibits the circulation of works:—

Class.	Vols.	Issues.		
A, History and Biography	969	4,070	—increase	19
B, Voyages, Travels, and Geography	708	2,584	—increase	244
C, Philosophy, Science, and General Literature	1534	2,956	—decrease	35
D, Miscellaneous	486	4 012	—decrease	33
E, Poetry and Works of Fiction	1401	17,080	—increase	3,029
F, Theology and Moral Philosophy	248	789	—increase	14
G, Bound Magazines	1013	2,340	—decrease	90
H, Works in Foreign Languages	80	257	—increase	2
Works of Reference	71	118	—increase	10
	6510	34,206		
Unbound Parts and Periodicals,		1,840	—decrease	435
		36,046		

168 volumes have been added to the library during the year. The Committee also report, in connection with the library, that they have received a valuable donation of books from the Trustees of University College, London. It will be remembered that a penny subscription was collected some years ago, with the view of raising a memorial to the late Sir Robert Peel, and that the amount was invested in the public securities in the names of the above trustees, who are to apply the dividends accruing therefrom to the purchase of books to be presented to Mechanics' Institutions and Public Libraries, or to the purposes of education generally, as they might deem the most advisable. On the announcement that the Trustees would apportion the sum at their disposal to the three Institutions which should substantiate their claim thereto, the Committee immediately laid before them the application of the Nottingham Institution; and, after the lapse of a few weeks, the Committee were informed that the Trustees, out of nearly one hundred applications, had decided in favour of those at Huddersfield, Manchester, and Nottingham. The following works, substantially bound, were accordingly presented, the selection being made by the Committee at Nottingham:—A Treatise on the Steam Engine, by the Artisan Club; Russell on the Properties and Application of Steam; Graham's Elements of Chemistry, 2 vols.; Pott's Euclid; Todhunter's Algebra; Brewster's Life of Newton, 2 vols.; Rankin's Manual of Applied Sciences; Haydn's Dictionary of Dates; Brodie's Psychological Inquiries into the Physical Organisation of the Mental Faculties; Fairbairn on the Application of Cast and Wrought Iron to Building Purposes; Bosworth's Anglo-Saxon Dictionary; Dallas' Elements of Entomology; Tredgold's Carpentry for the Use of Workmen; Atlas of the Society for the Diffusion of Useful Knowledge; and Knapp's Chemical Technology, by Ronalds and Richardson, 4 vols. The only condition accompanying the donation was that of placing a copy of the Memorial Deed, setting forth the circumstances under which the fund was originated, in one of the rooms of the Institution; a condition with which the Committee complied without delay. Several lectures have been delivered, which have yielded a considerable sum to the Institution funds. With regard to the classes, in the French class there are 20 students, the number reported last year being 18; the Discussion Class has 30 members, with an average attendance of about half that number. The subjects which have engaged the attention of the class are as follow:—"Recent Legislation for the Government of India"—"Emigration"—"Malthus and his Theory of Population"—"Light and Darkness, *versus* Malthus and his Opponents"—"Entomology"—"The Discoveries of Columbus"—"Cardinal Wolsey"—"Oliver Cromwell"—"Robert Burns, his Life and Works"—"The Discovery of America, considered in its bearings on Europe"—"Capital Punishments," &c. The chess class has 30 members, the largest number reported since its commencement. Dr. Robertson has resumed his course of lectures on Theoretical and Practical Chemistry, the delivery of which was interrupted by that gentleman's serious illness, as intimated in last year's report. The Committee have had under consideration, at various meetings, the subject of establishing a Board of Examiners in Nottingham, in connection with the Society of Arts or with one of the Universities. No definite steps, however, as yet have resulted from these deliberations. Since the arrangement entered into between the Committee and the Nottingham Naturalists' Society, the Museum has been visited by 1,700 persons. The proceeds of special and ordinary exhibitions have amounted to £13 5s. 4d., but as the expenses attendant thereon have been £15 11s. 2d., there is a deficiency of £2 5s. 10d. The Society are anxious that the museum should be open to the public every week day, and if a sufficient sum were subscribed to justify such a course, it would be immediately adopted. The members continue to assemble once in the week for conversation on some branch of natural history. The present number of members is 961, being an increase of nine as compared with last year. The balance sheet shows that the balance due to the treasurer has been reduced from £59 4s. 3d. to £39 6s. 6d.; and this, too, with a diminution of £70 in the income.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Entomological, 8.
THURS. ...Zoological, 3.
Royal Society Club, 6.
FRI. ....Astronomical, 8.
SAT. ....Royal Botanic, 3¾.

PATENT LAW AMENDMENT ACT.

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APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 24th*, 1859.]

Dated 18th March, 1859.

686. F. Potts, Birmingham—A combined metallic support and label for training, supporting, removing, and transplanting flowers or trees, in gardens, or green or hot houses, or for other horticultural purposes.

Dated 31st May, 1859.

1339. W. Smith, 18 and 19, Salisbury-street, Adelphi—Apparatus for raising and docking ships, and other similar purposes. (A com.)

Dated 1st June, 1859.

1350. G. H. Cottam and H. R. Cottam, St. Pancras Iron Works, Old Saint Pancras-road—Imp. in stable fittings.

Dated 6th June, 1859.

1381. T. Hyland, Manchester—Imp. in the manufacture of gum or dextrine, and their compounds from starch.
1383. J. Ferrabee, Phœnix Iron Works, Stroud—Improved machinery for forming bats of fleece or sheet sliver, and also for folding cloth and other fabrics.

Dated 7th June, 1859.

1385. C. Porley, Manchester—Imp. in machinery for preparing to spin, and for spinning cotton and other fibrous materials.
1387. P. Salmon, Glasgow—Imp. in valves for pumps and other uses.
1389. W. H. Dorman, Winchester-house, Old Broad-street, and C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in traction and locomotive engines.
1391. J. Greenfield, 8, Speedwell-street, Oxford—Imp. in fastenings for dresses and other like apparel.
1393. F. Muir, Paisley, N.B.—Imp in ornamental or colour printing.

Dated 8th June, 1859.

1395. C. de Bergue, 9, Dowgate-hill, London—Imp. in machinery for punching and shearing metal. (Partly a com.)
1397. N. Royer, Paris—Imp. in the manufacture of wadded or quilted fabrics, and in their imitation.
1399. C. W. Eddy, Kegworth, Leicestershire—An imp. in reaping machines.
1401. J. E. Ashby, Enfield—Imp. in sights for fire-arms.

Dated 9*th June*, 1859.

1403. G. Bartholomew, Linlithgow, N.B.—Imp. in shoes for horses and other animals.
1404. J. H. Tuck, 34, Great George-street, Westminster—Imp. in breakwaters, sea walls, and like structures.
1405. E. Welsford, Bona, Algeria—Imp. in tanning.

Dated 10*th June*, 1859.

1406. T. Greenshields, 11, Little Titchfield-street, London—Imp. in purifying gas and obtaining ammoniacal and other salts.
1407. M. J. Haines, Dursley, Gloucestershire—Imp. in the manufacture of driving straps or bands.
1408. G. J. Farmer, Hampton-street, Birmingham, and G. B. Hardy, Alexander-place, Brompton, Middlesex—Imp. in stair rods and eyes or sockets, which are also applicable for other purposes.
1409. A. F Haas, Camomile street, London—Imp. in lamp and gas shades or glasses.
1410. F. Puls, Roxburgh-terrace, Haverstock-hill—Imp. in the treatment of hydrocarbons.
1411. S. W. Tyler, Greenwich, New York—Imp. in harvesters.
1412. W. Sellers, Philadelphia—Imp. in ovens for baking bread or other substances, which improvements are also applicable for drying, annealing, and other analogous purposes.
1413. M. H. Picciotto, Finsbury-circus—Imp. in apparatus for producing or obtaining motive power.

Dated 11*th June*, 1859.

1414. W. Donbavand and D. Crichton, Manchester—Imp. in looms for weaving.
1415. J. James, Broadwall, Lambeth—Imp. in obtaining and applying motive power.
1416. F. Palling, Esher-street, Lambeth—Imp. in the construction of lamps for the purpose of burning tallow, grease or oils, either singly or in combination.
1417. T. F. Henley, Denbigh-street, Pimlico—Imp. in obtaining alcohol or spirit from rice and other grain, and in apparatus for that purpose.
1418. H. J. Nicoll, 114 to 120, Regent-street—Imp. in trowsers.
1419. A. V. Newton, 66, Chancery-lane—An imp. in fire-arms. (A com.)
1420. F. A. R. de Beauregard, Paris—Certain imp. in generating steam, and in apparatus for obtaining power and in generating steam for other purposes.
1421. G. C. Ash, West View, Hampstead—Imp. in the manufacture of artificial teeth.

Dated 13*th June*, 1859.

1422. B. Baugh, Salt's Patent Enamel Works, Bradford-street, Birmingham—Certain imp. in apparatus or machinery for raising metals.
1423. H. L. Corlett, Inchicore, Dublin—Imp. in rails, and the permanent way of railways, part of such improvements being applicable to common roads.
1424. O. Maggs, Bourton, Dorsetshire—Imp. in washing machines.
1425. A. Smith, 4, Stafford-terrace, Loughborough-road, Brixton—Imp. in bleaching and purifying bees' wax.
1426. C. N. Kottula, Liverpool—A means of cleansing or purifying the Thames.
1427. J. T. Smets, Plaçamen, France—Imp. in the manufacture of vinegar from grain and other vegetable products containing saccharine matter, and from a refuse product obtained in the manufacture of starch, also in apparatuses employed therein.
1428. A. V. Newton, 66, Chancery-lane—Imp. in the fitting of life and other boats. (A com.)
1429. W. E. Newton, 66, Chancery-lane—Imp. in the manufacture of piled fabrics, and in the machinery employed in such manufacture. (A com.)

Dated 14*th June*, 1859.

1430. G. Smith, Manor-road, St. Mary's, Newington—Imp. in hat-bands.
1431. W. Brown, jun., and S. Bathgate, Selkirk, N.B.—Imp. in machinery or apparatus for carding and treating or preparing fibrous materials.
1432. J. Dixon, Bishopwearmouth, Durham—Imp. in puddling steel.
1433. J. Cowan, Barnes, Surrey—An improved soap.
1434. J. Wansbrough, Bridge street, Southwark-bridge, and A. Bain, Clerkenwell-green—Imp. in effecting communications between parts of railway trains.
1435. A. MacDonald, Manchester—Certain imp. in machinery or apparatus for punching patterns or devices upon metallic printing rollers or cylinders.

Dated 15*th June*, 1859.

1436. E. J. Maumené and V. Rogelet, Reims, France—Using the "suint," or the portion soluble in water of the greasy substance found on the skin and hair of sheep, for the purpose of manufacturing potash and other products.
1437. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of polishing wheels, sticks, and tools. (A com.)

Dated 16*th June*, 1859.

1439. J. Taylor, Aberdeen—Imp. in planes or cutting tools for working in wood.
1440. S. Levy, Manchester—Imp. in hats, caps, or coverings for the head.
1441. E. T. Hughes, 123, Chancery-lane—An improved night lamp clock. (A com.)
1442. J. Luis, 1B, Welbeck-street, Cavendish square—A new siphon meter for liquids. (A com.)
1443. J. Luis, 1A, Welbeck-street, Cavendish square—An apparatus for regulating individually the pressure, expenditure, and light in gas burners. (A com.)
1445. W. Birkmyre, Port Glasgow, Renfrewshire, N.B.—Imp. in drying, treating, and preparing yarns or thread.
1447. C. H. Waring, Neath Abbey, Glamorganshire—Imp. in safety lamps.
1448. C. Wilkinson, Slaithwaite, Yorkshire—Imp. in doubling or twisting silk, cotton, worsted, linen, or woollen yarns, or yarns from any other fibrous substance.
1449. T. E. Tallent, Southwark-bridge road—Imp in the manufacture of leather, and in machinery for that purpose.
1452. H. F. Smith, 4, Dale-street, Manchester—Imp. in the manufacture of driving straps or bands.
1454. A. V. Newton, 66, Chancery-lane—Imp. in casting cylinders and tubes. (A com.)
1455. J. Harmer, Wellington-villas, Brighton, and W. Parsons, Scotland-street, Brighton—Imp. in fire-arms.
1456. T. Cattell, 30, Euston-square—Imp. in the manufacture of varnish and lacker.

Dated 17*th June*, 1859.

1457. T. Orrell, jun., Mill-hill, Bolton-le-Moors, Lancashire—Certain imp. in mules for spinning.
1458. H. Evette, Lisieux, France—A new system of bedding.
1459. E. T. Hughes, 123, Chancery lane—Imp. in treating and decomposing fatty substances. (A com.)
1460. W. H. Hammersley, Leek, Staffordshire—Imp. in stringeing, glossing, or finishing silk, and apparatus employed therein. (A com.)
1461. D. Deas, Carneil, Fife, N.B.—Imp. in reaping machines.
1462. R. A. Brooman, 166, Fleet-street—Imp. in generating anhydrous steam, and in apparatuses employed therein and connected therewith. (A com.)
1463. C. F. Vasserot, 45, Essex-street, Strand—Imp. in the construction of stereoscopes. (A com.)
1464. J. J. L. Guiblet, 11, Wilmington-square, Clerkenwell—Imp. in watches.
1465. A. V. Newton, 66, Chancery-lane—Improved means for assorting substances of different specific gravities. (A com.)
1466. J. Combe and R. Smalpage, Leeds—Imp. in winding and spinning machinery, and in arranging and securing a uniform delivery from cops, to be used as weft or warp, or for other purposes.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, June* 24*th*, 1859.]

June 24*th.*

2939. J. T. P. Newbon, T. Smith, and J. Brown.
2945. D. Edleston.
2952. W. B. Johnson.
2955. T. Steven and T. Scott.
2959. J. Macpherson.
2960. J. Davies.
2962. F. W. Turner.
2965. B. Browne.
2971. J. H. Johnson.
2999. J. H Johnson.
3006. H. Robin.
1. J. T. Pitman.
7. J. Oliver.
23. J. B. Morgan.
24. J. Luis.
70. W. E. Newton.
77. J. White.
91. W. Bray and W. T. G. Bray.
108. H. Critchley and S. Elston.
129. W. H. E. McKnight.
139. P. A. de Saint S. Sicard.
142. E. Brooks.
167. J. H. Johnson.
291. D. Moseley.
367. J. H. Johnson.
518. F. Weeks.
715. G. Gregg.
757. J. H. Johnson.
1003. J. Alison.
1016. J. Armstrong.
1074. A. Boyle.

[*From Gazette, June* 28*th*, 1859.]

June 28*th.*

2976. R. D. Kay.
2989. R. A. Brooman.
2990. R. A. Brooman.
2991. R. A. Brooman.
2992. R. A. Brooman.
2991. W. Burgess.
2996. J. Knowelden and R. D. Edwards.
3005. F. W. A. Casper and G. H. Schmahl.
3006. L. A. Normandy, jun.
4. B. J. Gosteau.
5. J. E. Drouot.
9. J. Garforth.
14. M. Wigzell.
22. A. L. Lévèque.
81. J. Biers, jun.
98. W. McNaught and W. McNaught.
145. R. Mushet.
175. T. Greenwood & J. Batley.
178. T. Greenwood, J. Batley, and J. Dockray.
182. H. Sagar and A. Schultz.
183. T. Richardson.
193. J. Childs.
223. J. H. Johnson.
262. H. Watson.
269. H. Grissell.
295. W. E. Newton.
509. A. Reid and R. Tonge.
845. D. B. White.
951. H. A. Silver.
996. H. Rawson.
1073. W. A. Tompson.
1119. W. E. Newton.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, June* 24*th*, 1859.]

June 20*th.*

1471. G. Riley.
1513. A. Shanks.

June 21*st.*

1468. G. Gurney.
1529. T. F. Henley.

June 22*nd.*

1501. G. Durrich.

[*From Gazette, June* 28*th*, 1859.]

June 23*rd.*

1477. E. Hardon and J. Henry.
1526. C. A. Messager-Abit.

June 24*th.*

1495. R. W. Chandler and T. Oliver.

Journal of the Society of Arts.

FRIDAY, JULY 8, 1859.

EIGHTH ANNUAL CONFERENCE.

The Eighth Annual Conference, between representatives from the Institutions in Union and the Council of the Society, was held at the Society's House, on Tuesday, the 28th June, at 10 o'clock a.m. Mr. C. Wentworth Dilke, Chairman of Council, presided.

At the conclusion of the Secretary's Report to the Council, read to the Conference and published in the last number of the *Journal* (see p. 543), the Chairman called attention to the following subjects proposed by the Council for consideration at the Conference :—

1. What arrangements can be made to enable the smaller and poorer Institutes to profit by the Examinations without loss to the Society of Arts?
2. Is it expedient to further define and prescribe the constitution and modes of action of the Local Boards?
3. Is it expedient to continue the system of giving Prizes in addition to the Certificate?
4. Would the Institutions, at their own cost, wish to receive, according to a rota, for local Exhibition, collections of some of the more portable and useful of the articles that are annually exhibited by the Society of Arts?
5. Can the Museums and Galleries in the Metropolis, which are the property of the public, or subsidised from the public funds, be rendered useful to the Institutions in different parts of the country, by systematically lending to them specimens for exhibition, or by granting to them unrequired duplicates?
6. Should an effort be made by the Union to procure the opening of the National Museums and Galleries to the public of an evening?
7. Is it expedient to apply to Parliament for an Act to extend to the Institutes and to the Local Boards the operation of the Free Libraries and Museums Acts?
8. Is it expedient that the Society of Arts should annually visit some one of the large manufacturing towns where there are Institutes in Union with the Society; and, if so, under what circumstances and conditions should such visits be made?
9. Do the Institutions agree with the Council in thinking it desirable to provide at the House of the Society facilities for the admission of members of the Institutions, visitors in London, to the different establishments and objects of public interest accessible gratuitously by ticket, and for seeing which much curiosity is usually felt by strangers?

The Chairman said, before entering upon the discussion of the first question, he would draw attention to some of the remarks of the Examiners in the various subjects, as given in the Appendix in the last number of the *Journal*, setting forth the opinions of those gentlemen upon the results of the Examinations recently concluded. Having quoted observations made by the Examiners under the heads of Algebra, Geography, Statics, Electricity, Practical Mechanics, &c., he proceeded to remark that his duty, as chairman, was rather to direct the business of the Conference than to take any prominent part in the discussion of the various important subjects that were to be brought before them. The object of the Conference was, that the representatives of the various Institutions in Union should put the Council in possession of their views upon the questions to be submitted to them, and those views the Council would take into consideration in order to see how far they could be carried out. There was one point not actually mentioned in the list, upon which the Council desired to consult the representatives, and that was the date at which the Local Examinations should be held, as affecting the interest and convenience of the Institutions generally. He would ask whether the 10th of May and three following days would be convenient, that period, lying between Easter and Whitsuntide, having hitherto been selected for the purpose? The programme, however, would be prepared in accordance with the decision of the Conference upon that point. He might state, that in only one instance had any objection been made to the time selected for the last Examinations, and that only referred to the hours. Generally speaking, the time fixed had been found convenient, and he would ask whether that accorded with the views of the Conference generally.

Several representatives expressed their opinion that it was undesirable to alter the period for the Examinations, and it was agreed that they should take place on the 10th of May and three following evenings; the programme to be prepared accordingly.

The Conference then proceeded to the discussion of the first question upon the agenda, as follows :—

1. What Arrangements can be made to Enable the Smaller and Poorer Institutions to Profit by the Examinations without Loss to the Society of Arts?

Mr. Barnett Blake (Yorkshire Union) would endeavour to confine himself to the merits of the question, and would ask the special indulgence of the Conference, because he believed the majority represented Institutions which were not affected by this question. With reference to the Examinations of the present year, he thought they were not so satisfactory as they ought to have been, so far as Yorkshire was concerned. It was true they had included Scotland and Ireland, but although Yorkshire had carried off one-third of the prizes, yet he considered the results were not satisfactory to the extent he had looked for. With regard to the smaller Institutions, the Council had made the liberal concession that they might avail themselves of the Examinations by a payment of 2s. 6d. for each Candidate, provided the privilege be not exercised in favour of any Institution having more than fifty members, or an annual income of more than £50. He asked them to modify that regulation, for within a circuit of eight miles around Leeds there were about forty Institutions, the majority of which could have no claim to this concession; but amongst that number there were fourteen who had not an income of £50 a-year, although they had considerably more than fifty members. The average income was not more than £27 per annum each, and they were incapable of paying the annual subscription of two guineas to the Society. They numbered on the whole 6,000 members educating 2,000 pupils. He asked the Council to make a further concession in favour of those Institutions, depending upon their income and not upon the number of members, for their numerical strength was no test of their ability to pay the subscription; but, in order that the concession should not be all on one side, he proposed that the fee proposed for each Candidate should be doubled. The Committee of the Yorkshire Union had made use of every means in their power to render the Examinations successful. Previous to the first Examination, he had sent circulars to every Institutions within reach, pointing out the means by which they could acquire the advantages held out. Still there was a disinclination to avail themselves of them, and this he was anxious to remove. He would, therefore, submit the following resolution :—

> "That this Conference respectfully suggests to the Council of the Society of Arts the propriety of admitting to the Examinations members of all small Institutions in connection with country Unions having an income of less than £70 a-year, upon the payment of five shillings for each Candidate."

If that concession were made, it would considerably promote the extension of the Examinations.

The Chairman might consider this resolution as seconded, as he had a letter from Mr. Hole, or the Leeds Mechanics' Institution, supporting the views of Mr. Blake on this question. He was quite sure the Council would be prepared to reconsider the question; indeed, he might say it had been already under consideration. They had tried to meet the views of the smaller institutions last year by the means to which allusion had just been made; but they had seen that practically the difficulty had not been met, and therefore he repeated the Council were quite prepared to reconsider the question.

Mr. Harry Chester remarked that the question had a larger bearing than Mr. Blake, as representing merely the Yorkshire Union, had given to it. There were a number of Institutions not connected with the Yorkshire Union which were interested in this question. The chairman had very truly stated that the Council had given this subject a great deal of consideration. They had been anxious to make arrangements which, without pauperizing the system of Examinations, would make it more easy for the smaller Institutions to profit by the advantages which were offered. He thought the argument which Mr. Blake drew from the small number of candidates presented by the Yorkshire Union this year was not a very weighty one; at least it was not so to his mind; for, although he gave Mr. Blake, who was a true friend of education, full credit for endeavouring to give effect to the system, yet, the report of the Committee of the Yorkshire Union last year put the matter before the members of the Yorkshire Institutions in anything but an encouraging manner, stating that the system could not be effective unless it was much altered, and moreover, holding out hopes that it would be altered. Under those circumstances it was hardly surprising that the Institutions in connexion with the Yorkshire Union had not availed themselves of the Examinations so much as Mr. Blake desired. In Yorkshire, particularly in Leeds, there were Institutions, not in connexion with the Yorkshire Union, which had largely availed themselves of the system, and had sent a larger number of candidates this year than on any previous occasion. He thought the whole subject required to be most carefully considered. It was very desirable, if possible, to make the system of Examinations self-supporting, for at present it was not so. It was clear to him that the limitation which the Council had placed upon Institutions not having fifty members, and whose income was not £50 a year, was too narrow. He should like the Council to consider, also, whether it was not possible to make another alteration, so as to make the Examinations more self-supporting; namely, by charging a higher fee for persons in a superior class of society. They had applications from such persons of both sexes to be examined. The primary object of the Examinations was to encourage the instruction of adults belonging to the working and middle classes, but they did not wish to prevent other persons from availing themselves of the advantages if they could do so without injury to the class for whom the Examinations were principally intended. It was to be remarked that the Examinations were only competitive so far as the Prizes were concerned. If a candidate gained a certain number of marks he obtained a certificate of the first, second, or third class; and the only effect that would be produced by the admission of persons of a higher education would be, to give a greater value to the like certificates obtained by the working man. But when they came to the Prizes there was competition. The highest number of marks obtained the prizes, and he thought that those who had had the advantage of a superior education ought not to be permitted to compete with the working man for the prizes. The higher fee, however, which he suggested for such cases, might help to make the system self-supporting, and ultimately enable the Council to admit candidates from the Institutions at a lower fee than they could otherwise afford. There was a difficulty about reducing the subscription of two guineas per annum from the Institutions, for that was the amount paid by every individual member of the Society. If they reduced it to one guinea in the case of the Institutions, they would naturally be met by an application for the reduction of the subscription of members to the same amount. But at the same time the Council were extremely desirous to meet, as far as possible, the views of the Institutions, and anything the representatives might suggest to make the system self-supporting, and at the same time to make access to the Examinations more easy, the Council would be very happy to take into their consideration.

The Chairman apprehended that there was no objection to the resolution proposed by Mr. Blake, which he would now put to the meeting.

The resolution was then carried.

2. Is it Expedient to Further Define and Prescribe the Constitution and Modes of Action of the Local Boards?

Mr. Barnett Blake would remark upon this subject that even where the Institutions most abounded, there seemed to be a want of knowledge as to the means of gaining access to the Local Boards. There were facilities enough, probably, in the large towns of the south; but in the north, with the numerous scattered and widely spread villages, it was very different. There was, however, in such places abundance of the raw material to produce candidates for examination, but for want of a more extended knowledge of the system, the advantages offered were not sufficiently made use of. Moreover, he would advise that the Local Boards should have the direct sanction of the Society of Arts in their appointment; and then he was sure gentlemen would feel it an honour to act upon those Boards. He would also suggest that there should be a regularly appointed local secretary in each district, to whom application for information on the various particulars could be made. It would facilitate the operations of the Local Boards, and be the means of giving the young men in the district an opportunity of acquiring all the information they required relative to the time and other conditions of the examinations. He had embodied his views upon the subject in a resolution which he now begged to submit:—

"That it is the opinion of this Conference that in the establishment of Local Boards of Examiners, the appointments of the several members should receive the direct sanction of the Council of the Society of Arts, that a permanent secretary should be appointed, to whom all applications for information, &c., should be made, that only one Local Board should be established in any town, or within five miles of it; and that public notices of the appointment of the Board, the names of the Examiners, the name and address of the secretary, the subjects and conditions of the Examinations, and other particulars, be freely posted in the district comprised in the operations of the Board. It is also the opinion of this Conference that one gentleman, at least, from the Society of Arts, should be present at the Examinations of each Local Board, or that a stranger to the district should be deputed for the purpose."

At present there was a great lack of knowledge of the particulars of the system amongst those to whom these Examinations applied. Mr. Chester had stated that a hope had been expressed by the committee of the Yorkshire Union that some alteration would be made in the plan of Examination; but, although they had not been so numerous in candidates as on previous occasions, yet Yorkshire had borne off a large proportion of the prizes.

Mr. Chester remarked that the whole of Yorkshire was not comprised within the Yorkshire Union.

Mr. Blake believed it would be very beneficial if one or more gentlemen were deputed by the Society of Arts to attend the local Examinations. That opinion was strongly expressed at a meeting at Rotherham, and it was stated that the Examinations, being left entirely in the hands of local men, were not considered satisfactory. In the case of Huddersfield, where it might be supposed they had better opportunities of preparing candidates than in many other places; where they had better teachers, and, perhaps, better pupils, they refused to send any candidates because they were not satisfied with their Local Board. He did not for a moment suppose that those who undertook the position of Local Examiners were other than men of the highest honour, but many of them were not accustomed to the work, and there would be negligence in that as in all other things of the kind that were left to individual exertion, besides which, it was to be feared that in all cases the instructions of the Council were not always carried out to the letter. He believed in many instances there would be no difficulty in those who were examined helping themselves to all the assistance they chose without control from the Local Board. What security had the candidates of one Local Board that the Examinations of another Local Board—perhaps in the same town—had been conducted with perfect fairness?

The Rev. Canon Girdlestone (Bristol Athenæum) desired to defend the Board to which he belonged from the observations which had just been made. For his own Board be would say that nothing could have exceeded the care and diligence with which every member had discharged the duties, and, speaking on behalf of that body, he did not believe it possible for the whole programme of the Examinations to have been carried out more carefully or more faithfully. He could not believe that the remarks just made had any application to the Local Boards in general.

Rev. W. Lusignan (Crosby Hall Evening Classes) said, being himself a member of the Local Board at Crosby Hall, he could state that they made it a strict point to see that no improper aid was obtained by the pupils in their Examinations, and he could bear testimony to the highly efficient manner in which the business was conducted.

The Chairman thought the Examinations on the whole must have been reasonably well conducted, otherwise they would have had the candidates themselves remonstrating and stating that one was more successful than another, because he had had means of obtaining assistance. He thought, generally speaking, the Examinations must be regarded as having been satisfactory to the parties concerned. On one or two points he did not agree with Mr. Blake. He did not think it was at all the province of the Society to placard the districts with bills expatiating upon the merits of the system of examinations. He thought the duty of making the Examinations known devolved upon the Boards of Examiners in their respective localities. With reference to Mr. Blake's suggestion that the appointment of every individual member of the Local Board should receive the sanction of the Council of the Society, there was a great amount of difficulty attending such a proposition. The Council, being at a distance, really could not know the respective merits of gentlemen in every part of the kingdom. It would be impossible for them to say whether the merits of one gentleman were superior to those of another as an Examiner; and on that ground he thought they had better not interfere with the Local Boards. Again, upon the point that a stranger to the district should be present at the Examinations, he thought nothing could be easier than for the Local Boards to manage this for themselves; for instance, Sheffield might invite a gentleman from Leeds, and *vice versa*, whereas if this duty were imposed upon the Society it would be found practically impossible to carry on the examinations. How great would be the difficulty of getting fifty or sixty gentlemen to be present at the different localities as representatives of the Society! Even when only one country centre at Huddersfield was in operation this difficulty arose, but if the Society was asked to send a representative into every locality where Examinations took place, the system must break down.

Mr. George Gibb (Halifax Working Men's College) would be happy to second the latter part of Mr. Blake's resolution, as he believed the *prestige* of the presence of a stranger at the Examinations would be very great. With regard to other portions of the resolution, he might mention that at Halifax the attempt had been made to unite the two Boards into one, but it was found impossible to do so. With reference to the Examinations themselves, he believed they were as well conducted in Halifax as if they had been held in London; nevertheless, he thought it would give a *prestige* to the Examinations if a gentleman was sent down to each of the local centres. If the Institutions would undertake to defray the expenses, he had no doubt gentlemen from London could be found to undertake the duty.

The Chairman said there would be no difficulty in any Board that desired it making an engagement of that kind. The year before last Mr. Akroyd offered to defray the expenses of some gentlemen to attend the Examinations in his locality, but he was afraid the Council of the Society could hardly deal with the question.

Mr. Blake quite agreed with the Chairman that the placarding of the district should be done by the Local Board themselves; but if the Council could organise a centre in each locality where the necessary information relative to the Examinations could be obtained, he thought it would be an advantage. With regard to the question of having only one Local Board in each locality, he thought it was the division of interests, if he might so term it, in the same town, that did the harm.

The Chairman would remind those present that, with reference to the Boards at Halifax and Leeds, the Council had done all they could to promote union. They felt as much as any one could do the inconvenience of having more than one Local Board at those places. He would ask whether any representative was prepared to second the resolution submitted by Mr. Blake.

Mr. John Lee (St. Mary's, Islington) would second the resolution. He was of opinion that one Board of Examiners for all the Institutions in a locality would be found to work well.

Mr. Chester said, what had fallen from Mr. Blake was very important. It was certainly desirable that each Local Board should represent more than one Institution. They had by that means great security against anything like unfairness. Mr. Blake could not be more anxious than he was that there should be only one Local Board in each town; but the settlement of that question must depend upon the locality itself. If a large city like Leeds could not agree that there should be but one Board, the Society of Arts could hardly hope to interfere with advantage. At the same time, he thought it might be desirable that the Council should exercise a little more influence than they had hitherto done in dealing with Local Boards. If the names of a Board were sent up to the Society, and the Council saw that it was a small and weak Board, they might, by correspondence, endeavour to get it extended and strengthened; and some good might be done in that way. But it was of the last importance that the Council should not interfere unnecessarily with the Local Boards. Unless these bodies felt the responsibility of their position, the system would fail altogether. He was afraid Mr. Blake had been unfortunate in his experience, as he (Mr. Chester) believed the working of the Local Boards had been highly honourable to the members. He believed they had taken great pains with their work, and he thought it had been well done. He agreed with the chairman that, had there been any just grounds of complaint as to the conduct of the Examinations in general, the Council could hardly have failed to have heard of them. With regard to the presence of a stranger at the Examinations, he thought the only effect of that would be to weaken the responsibility of the Boards themselves. That feeling of local responsibility the Council wished to cultivate as much as possible; and, if the friends of education in each locality could not be trusted to do this work, it would never be done at all. If they distrusted their friends in the country, would they not also distrust the distinguished "Strangers" whom the Society was invited to send down. He believed the Examinations, as far as they had gone, had been conducted with perfect fairness. The Council would, however, give this subject careful consideration, and any improvement that could be devised in this direction would be most readily and cheerfully made.

Rev. J. S. Howson (Liverpool Collegiate Institution) said this question of the Local Boards was one of extreme importance in many points of view. He sympathised to some extent with Mr. Blake in his remarks. Mr. Blake had said that much evil had been occasioned from a want of proper information with regard to the Examinations. He had himself known instances in which young men had not obtained the necessary information for their guidance until it was too late to come up for examination. Then there was another evil arising from the want of fixity of the central board. It was held in one place one year, and in another place the next year, which produced considerable uncertainty. In Liverpool they had two Local Boards last year; this year they had only one; but there was a tendency to separate in smaller towns which did not exist in Liverpool. He hoped the Society of Arts would be very despotic with regard to the Local Boards, and that they would insist upon each geographical district defined by them having only one local centre. He was persuaded that some such plan as that would save the young men a great deal of confusion. He thought, also, some embarrassment had been occasioned owing to the young men not having had warning of what they had to do in sufficient time to prepare themselves for examination. He should be very glad if the Society would look upon this question with reference to the other duties which were devolving upon the Local Boards, and which would be increased as time went on. There had been four schemes of public examination already instituted in the country. In the first place there was the Civil Service Commission, and they knew that one of the great wants of this Commission was some local assistance in matters of routine, by means of which the young men could be examined without leaving their homes. That want could be supplied by each locality, if they could only get hold of the right persons. Then, again, there were the Oxford and Cambridge Middle-class Examinations, which had apparently become a rooted Institution. One feature of their system was the establishment of fixed Local Boards, the duties of which were matters of routine. Then there were the Examinations of the University of London, which were conducted similarly to those of the Society of Arts, and of Oxford and Cambridge. Then there came the Examinations of the Society of Arts. It appeared to him that the self-same body of Examiners might perform all these duties, and a great deal of waste of time, and local disputes and quarrelling might be saved if this could be effected. They wanted a fixed and well-known place of Examination. A "Hall of Examinations," in various districts would be the best placard for diffusing the information of which Mr. Blake was so desirous. Then they wanted a guarantee for punctuality, integrity, and impartiality. For his own part he was convinced that each locality was capable of producing persons qualified for these duties. With regard to deputing gentlemen from one town to another to attend the Examinations, he did not think, for instance, that the people at Rotherham would like to have a gentleman from Liverpool to watch over their proceedings. If the Examinations of the Society of Arts were put into connection with those of the Civil Service and of Oxford and Cambridge, the cloud would clear away, and they could then see their way to the formation of valuable permanent Local Boards. He thought they might thus establish such an organisation of Local Boards as would promote the cause of education in the country to a very great extent.

Mr. Barclay Phillips (Brighton) said they, in Sussex, had taken the bull by the horns, and for the last year and a half they had to a great extent established the system advocated by the last speaker. It devolved upon him (Mr. Phillips) to organise the Sussex Board of Examiners. He sent circulars to all the important and influential gentlemen throughout the county, and also to the Secretaries of Mechanics' Institutes, inviting them to a meeting for the purpose of forming a Local Board for Sussex—for the whole county—which Board was elected annually to carry out the Examinations instituted by all the towns in the county. They began in the first instance with the Examinations of the Society of Arts, after which it was proposed to embrace those of the University of Cambridge, and they had just undertaken those of the University of Oxford; and he had only that moment received a letter from Mr. Sewell stating that they had had less trouble with Brighton than with any other district in the county. This Board had so worded their constitution, that they could act for the Civil Service or any other Institution which established Examinations of this kind. In his district the work was done for the three Universities, and also for the Society of Arts; and their plan was this—every subscriber of 10s. a year to the general fund was allowed to be a member of the Local Board. Every Literary Society in the county in union with the Society of Arts was allowed to elect three of its members as its representatives at the Local Board. They had elected a working Committee, consisting of 21 members, who transacted the business in connection with the Institutions of the whole county. He believed that had been the means of saving great expense, and also of concentrating public attention upon all these Examinations, and every person readily knew where to apply for any information that was required, and the moment a letter of inquiry was received, an answer was sent. He was sorry to say, as regarded the Society of Arts, that the Local Board had only had one or two candidates. Unfortunately they had had no candidates from the class which they principally wished to benefit—viz., members of Mechanics' Institutions. The Sussex Board had established a prize fund amongst themselves, in which no distinction whatever was made between the several classes of candidates. The most distinguished candidates at the Oxford and Cambridge Examinations or at the Examinations of the Society of Arts were entitled to certain prizes, and they were making great efforts to establish foundations and scholarships at the Universities themselves. They found with one working committee they had no local jealousies, for the whole of the Institutions in the district had joined in the system with the exception of the Railway Institution at Brighton. With regard to the interference of the Society in the appointments of the Local Boards, all he could say was that, with regard to Sussex, the system established was really so perfect that no interference was necessary. It was the sense of personal responsibility that induced them to take up the subject so energetically. In their Examinations there had been nothing to give rise to the least breath of suspicion; everything had been conducted in the most fair and honourable manner, and those examiners who had signed the returns of the candidate who attended the final examination were present from first to last. To send down a special examiner into every locality, would entail an expense upon the Society which it would be unfair and unreasonable to expect them to incur.

Sir Thomas Phillips had no wish to prolong this discussion, but thought it would be impossible to throw upon the Society the additional responsibility which would attach to it if the resolution now before the Conference were adopted. They must fairly decide between two opposite systems—local action and local organisation, or the irritation which would be so likely to accompany undue interference by the Central Society. They had before them a proposition that the Society should be answerable for the composition of the Local Boards of Examiners. They were asked in effect to give a certain sanction to the Local Boards by making the Society responsible for the fitness of the persons proposed; whereas, if it attempted to exercise that discrimination, it would come into conflict with all local authority. The resolution further proposed that it should be answerable not only for the character of the local examiners, but also for the conduct of the local Examinations; for it was obvious that if a delegate was sent down to check and control and to become in fact the sole authority for the conduct of the examination, anything like interest or responsibility on the part of the local board ceased. This would put an end to that feeling which gave an Englishman earnestness—the sense of responsibility and the knowledge that upon him was cast the trust of seeing that what had to be done was well and rightly done; and in every point of view it seemed to him that in this proposition they were asked to take a wrong course, because it was one which tended to destroy local life and vigour. It might possibly be that some little imperfections had disclosed themselves in the past action of the Local Boards; but they had not been long in operation; they were testing their own powers; they were working their own way; they were acquiring experience which would fit them for the perfect discharge of their duties, and it was not wise to interpose at this stage, before the experiment which hitherto promised so well had been fairly tried. He felt that unless they could have the work done in the localities, it never could be permanently done, and therefore he was anxious not to lessen the sense of local responsibility. With regard to the question of having two boards in one town, there might be local or temporary reasons for this in some places, and it was not for the Society to say that it would recognise students for examination through one board, whilst it rejected those coming from the other board. He agreed that by judicious suggestion they might bring about some better feeling where local jealousies had sprung up; but even these were not all evil, they were proof of the interest taken in the subject; the very existence of rivalry showed there was life, which it would ill become the Society to extinguish.

Rev. Canon Girdlestone protested against its being considered that the local jealousies to which allusion had been made were the rule rather than the exception. He did not know what peculiarity there was in the geography or the geological formation of Yorkshire, but he thought, upon a fair examination, it would be found that it was in Yorkshire alone that these explosive elements, which were alleged to exist there, were found to any great extent. He was happy to say they did not exist in Bristol. There they had amalgamated all shades of opinions in one Board. He hoped the Council would not feel it to be their duty to interfere more than they did at present in the operations of the Local Boards. It had been well said that the only way in which these Local Boards could be worked with the prospect of carrying on successfully the task they had undertaken, was upon the principle of their being considered responsible for it. The scheme which his reverend friend, the principal of the Collegiate Institution of Liverpool, had advocated, was an admirable one if it could only be carried out. If one Board in every place could be formed for carrying out the various schemes of Examination, there was no doubt they would all be saved a large amount of trouble and annoyance; but he would suggest that the only way in which that scheme could be carried out had been practically set before them by the representative from Sussex. It could only be done by the localities themselves; and he felt confident that if the Council of the Society undertook to organise such a scheme as that, it would prove a signal failure. He believed, if the Local Boards were left to operate upon the principle of personal responsibility, in most cases they would work well, and he thought they had generally done so.

Mr. J. Whitwell (Peterborough Mechanics' Institution) would propose as an amendment,

> "That the appointment of local boards be arranged as heretofore, with the recommendation that each locality shall appoint only one local board."

Mr. W. Mathews, jun. (Birmingham Institute), seconded the amendment.

Mr. T. J. Pearsall (London Mechanics' Institution) could not agree with what had fallen from several speakers as to the difficulty on the part of students in obtaining information relative to the Examinations. The programme of the Society was forwarded to the accredited persons, and that programme could be reprinted at a very small cost and circulated in the several districts to any extent which the local boards thought desirable. It was also an easy matter to accompany the programme with a statement when the examinations would be held, together with such other information as it was desirable to communicate. He suggested this as the means of overcoming the difficulties to which Mr. Blake had alluded. He thought the suggestion of the last speaker was a very proper one—viz., that they should not interfere with the present mode of appointment of the Local Boards, but that the Conference should express its opinion as to the desirability of having only one local board in each town or locality.

The Chairman said the Council had done more than had been suggested. They had sent the programme, which included all the information that Mr. Pearsall had mentioned, to every Institution, and any number of programmes within reason that might be required had been supplied gratis. It therefore only remained for the Local Boards to distribute them as they thought desirable. Practically there was no limit to the programmes which the Society had given away. With regard to the proposition that there should be only one Local Board in each town, this was what the Council had all along desired, and a great deal of correspondence had taken place between them and the Halifax and Leeds Boards, in the hope of bringing the Boards in each of these places into union. In one letter the Council had stated that if it was thought desirable that a deputation from the Council should attend to urge the point, Mr. Chester and himself would meet them in order to see whether they could not bring the Boards into harmonious action. It was thought that if any local differences existed, they might be smoothed over by parties from a distance who were uninfluenced by any local feeling whatever.

Mr. Robt. C. Radcliffe (Blackburn Literary and Scientific Institution) said the successful working of the present system of Local Boards could only be ascertained by the expression of opinion upon the subject by the several delegates themselves. He would say that the general opinion in Lancashire was that the system adopted by the Society could scarcely be improved upon, and they regarded it as an almost complete success, so far as by correspondence he had been able to gather the opinions of the various localities. The Local Board at Blackburn was composed of gentlemen who had themselves passed college examinations and had obtained degrees in their several professions, and he thought there could not be the slightest suspicion of unfairness, neglect, or partiality in the conduct of the local examinations. He could speak with the fullest confidence in that respect with regard to his own locality. It was considered an honour to have the conduct of these examinations, which were attended on some occasions by the authorities of the town and the Boards of the collegiate establishments of the district, who manifested great interest in the matter. They, however, took no part in the proceedings, but attended merely as spectators. His instructions from the Institution which he represented were to support the system which had already been adopted by the Society, and he thought nothing had been advanced to induce them to alter their present plan with regard to the appointment of the Local Boards.

Mr. F. R. Sandford remarked that there was one great fact from which they might infer that the local Examinations had been fairly and satisfactorily conducted, which was that there had been no complaints either from Examiners or Examinees. The papers had been looked over by distinguished men, familiar with the work of Examition, and if there had been any indication of copying or of undue assistance in working the papers, it could not have escaped their critical notice. Having had some experience in Examinations on a large scale, he could say that if there had been unfairness on the part of any two or three candidates, there would either have been some complaint about it, or the Examiners would have discovered it. When he considered the class of men examined, he should scarcely expect any unfairness on the part of the candidates themselves, because they were not forced into an examination, like schoolboys or college students. They were persons who had studied to benefit themselves, and who were anxious to show that they had profited by what they had studied; therefore it was not likely that there had been any unfair dealing on their part.

Mr. Radcliffe remarked that one member of the Blackburn Board was an operative mechanic.

Mr. F. Talbot (Messrs. Chance's Library and Reading Room) said it had occurred to him that great benefit would accrue if some gentlemen locally interested in this subject would undertake to apprise the various Institutions and Local Boards in the district of what the Society proposed doing. From personal inquiry in his own immediate locality, he had ascertained that the leading men of the Institutions were not always acquainted with the Society's system.

Mr. Binyon (Clerkenwell Working Men's Institution) said it would be out of place for him, as the representative of a London Institution, to take any prominent part in the discussion of the question as to the constitution of Local Boards, but he thought Mr. Blake, in stating the difficulties there were in making known the objects of the Society in the more remote localities, had taken a wrong view of the subject. They, of course, assumed that the Local Boards were members of some Institution in Union with the Society of Arts, and as such there could be no difficulty in making themselves acquainted with the whole programme of the proceedings. It appeared to him that the qualification to become a candidate for Examination should be a longer period of membership in an Institution than three months, and if the committees of Institutions would make it their business to bring forward their connexion with the Society of Arts in all their proceedings, the whole body of artisans in the district, who were members of the Institution, would be acquainted with the purposes of the Society in these Examinations. That was done in his own Institution, and he thought with very little trouble on the part of the Executive of Institutions, the members would have no plea for saying that they were unacquainted with the routine of the Society's system of Examinations.

Mr. Blake would only remark that he never supposed for a moment that the Society was to be responsible for individual appointments upon the Local Boards; but what he argued was that they should not recognise the appointment of more than one Local Board in one town. He believed such a course would very much tend to heal local differences. He had brought forward no charge against any Local Board, and therefore he thought Mr. Chester was hardly justified in saying that he had been unfortunate in his experience. Still he said, without some sort of supervision, laxity would often occur; and it might be the case that the letter of the instructions was not always strictly acted up to even at the Oxford and Cambridge Middle Class Examinations. Care was always taken, however, that one or two representatives should be present, although it was true the centres were fewer. He was quite willing to forego that part of the resolution, but he would adhere to the portion which recommended some steps on the part of the Society to render the Local Boards more permanent than they were at present.

The Chairman then put the amendment of Mr. Whitwell, which was carried by a large majority.

3.—Is it Expedient to Continue the System of giving Prizes in addition to the Certificate?

Mr. Barnett Blake thought it was very questionable whether it was desirable to continue the prizes to candidates as at present. He suggested that the prizes should be confined to the Institutions from which the candidates were sent, and that the rewards given to the candidates themselves should be of a local character. If the various localities liked to get up prize funds let them do so, but he suggested that as far as the Society's prizes were concerned, they should be confined to the Institutions which sent up the largest number of successful candidates or obtained the largest number of certificates. He thought that would stimulate the Institutions, and would do away with rivalry on the part of the candidates themselves. It was to be supposed that the certificate of the Society of Arts was the great object coveted, and that when that was obtained they had earned all the Society could give. He would therefore move—

> **"That in the opinion of this Conference the award of prizes from the Council of the Society of Arts might be limited to the Institutions the members of which obtain first-class certificates, but that prizes to the candidates might be awarded from funds subscribed specially for particular localities."**

This motion having been seconded,

The Chairman read the regulation upon the subject of prizes, and explained that the object of giving prizes to Local Boards was to encourage them to sift the candidates who were to undergo the final examination, and that it should be considered a slur upon them if they sent up twenty candidates, and only two or three obtained certificates.

Mr. Vallentine (London Mechanics' Institution) thought the Society had not established a proper test with reference to the prizes given to the Local Boards. At present those Boards obtained prizes whose candidates carried off the largest number of first-class certificates in proportion to the number of candidates examined, the duty of the Board being, as the chairman had described it, to sift the candidates. It seemed to him that a Board which sent up twenty candidates, eighteen of whom carried off certificates—first, second, and third class, did its duty better than another Local Board sending up as many candidates, five or six of whom obtained first-class certificates, and eight or nine obtained no certificate at all; because this showed that it did not exercise the duty of sifting so well as the Board which had a larger number of certificated candidates, though they might be of a lower grade. He would suggest that the prizes should be given to the Local Boards on the ground of the smallness of the number of unsuccessful candidates, irrespective of the class of certificates granted.

Mr. Chester very much agreed with the last speaker. The object was to encourage not merely a few persons of extraordinary talent, but the great body of adults who availed themselves of the Institutions for instruction. He thought that the alteration suggested by Mr. Vallentine might be advantageously adopted. But with regard to the question whether they should offer any prizes at all to the candidates themselves, the Conference must be aware that it was no advantage to the Society to offer prizes. What the Council wanted to know was whether, in the opinion of the Conference, these prizes were calculated to produce the effect aimed at; if it was considered that they were an encouragement to candidates to present themselves, and an encouragement also to the Institutions to prepare their candidates, the Council would do their best to continue them; but if, on the other hand, the Conference thought the certificates were a sufficient incentive, the prize system would be given up.

Mr. **Vallentine** (London Mechanics' Institution) thought the prizes to the candidates were a great stimulus to competition.

The Rev. J. B. **Owen** (Royal Polytechnic Institution Classes) thought it would be desirable, if the Society felt itself in a position to do so, to continue the present system of prizes both to candidates and Institutions. At the same time, it might be worthy of consideration whether the rewards to the most successful students should not be something of a more permanent character than a sum of money, which, when expended, might be altogether forgotten.

Rev. Canon **Girdlestone** was specially charged by the Institution he represented to support the present system of awarding prizes. It was believed to be productive of great benefits. He should, however, be disposed to fall in with the views of the last speaker as to the nature of the prize awarded.

The **Chairman** said it might be well to state a case which had occurred this year. A candidate from Bristol had obtained four first-class prizes, and would, of course, receive the money, though the Institution from which he was sent would not receive anything, because the successful candidate had not attended classes in that Institution, and therefore it had no claim upon the prizes offered. These, it should be stated, were provided by private subscriptions from members of the Society, as the Council did not feel themselves at liberty to saddle the Society with the entire cost of promoting this educational movement.

Rev. W. **Lusignan** said it was the opinion of his Local Board that the prize list should be continued. They felt that the certificate alone would not operate so well as when accompanied by a prize.

Dr. **Ellis** (Richmond Parochial Library and Local Board) advocated prizes of a more permanent and substantial character than money — something that could be handed down as a family heir-loom, such as the Society's medal, which, he thought, would be more valued than money, which was unfortunately of a particularly evanescent character. He thought this was a subject worthy of the consideration of the Council.

Mr. **Chester** remarked that at present it was at the option of the successful candidates to take the prize in money or in books.

Dr. **Ellis** was not in favour of book prizes, as, thanks to the publishers of the present day, books could be obtained cheaply enough; but they could not always get such a prize as the Society's medal.

Mr. **Sandford** remarked that when a prize was gained, the award of it was inserted in the certificate which necessarily accompanied it.

Mr. **Robert Hunt**, F.R.S. (Chelsea Athenæum) would mention that during the time he acted as secretary of the Royal Cornwall Polytechnic Institution, they awarded medals for every effort of human thought; and he found that although it was at the option of the party to receive either a medal, money, or books, yet the medal was almost invariably preferred.

Mr **Pearsall** was in favour of stimulus to the Local Boards. He thought that the prizes should be awarded in proportion to the smallness of the number of candidates rejected. Out of ten candidates from the London Mechanics' Institution nine had been successful.

Rev. J. B. **Owen** was in favour of prizes to Institutions. In the case of the Polytechnic classes, every Candidate they sent up was awarded a certificate, and it was due to that Institution to state that out of thirty-seven certificates awarded in chemistry, eighteen had been taken by pupils of the Royal Polytechnic. They had, however, received no assistance in the shape of prizes. He thought there should be some recognition by the central Society of the Local Boards, and he believed that to be of more importance than the prizes to individual candidates.

Mr. W. **Mathews**, Jun. (Birmingham and Midland Institute) said he had handed in a series of resolutions passed by the Council of the Institution which he represented, founded upon their views of this question. They were strongly of opinion that it was expedient to continue the prizes to successful candidates as well as the certificates—for this reason among others—that the certificates did not indicate who was the best man of his year in each subject, and he thought it was important to have that fact recognised in some way or other. As to whether it was expedient to continue the system of giving prizes to Institutions, as far as the body he represented was concerned, they were quite indifferent upon the subject. If the Institution which he represented had gained a prize, they would have considered it their duty to hand it over to the best student.

The **Chairman** said he gathered that the general expression of the Conference was in favour of retaining the prizes.

Mr. **Chester** suggested that a resolution to that effect should be passed, and that it be left to the Council to consider whether, hereafter, the candidates should have the option of receiving medals instead of money prizes.

Dr. **Ellis** would vote for a resolution recommending the abolition of money prizes and establishing the Society's medal as the award to successful students. It was only in cases where the students lost the wages of a day's work that the money was an object. He did not think the local examiners required the stimulus of prizes in order to do the work well. If any reward at all was to be given, he should suggest that it should be in a more permanent shape than money.

Mr. **Blake** had spoken of the prizes being confined to the Institutions, by which the money might be much wanted. The other difficulty with regard to the candidates was provided for by the latter part of the resolution. Let those localities which attached importance to the matter raise a prize fund for their candidates. The certificate was something to look at, and it could be hung upon the wall more readily than a medal.

Mr. **Binyon** hoped, whatever might be the decision upon the question of continuing prizes to Institutions, the rewards to the candidates would be retained. He was sure with the operative classes the prizes were a great incentive to exertion. If a working man by a course of study carried away a prize and a certificate, it could only be done at some expense to himself, as well as by exertion and labour. When, therefore, they obtained a money prize it gave them heart to take another step upwards. He thought the prizes to the candidates should be continued, unless it was desired that the Examinations should be confined to the classes by whom an honorary medal would be more valued than a money prize. Unless they wished to deprive the operative classes of the benefits of Examination, he earnestly begged that the Conference would impress upon the Council the great desirability of retaining the money prizes to the candidates.

The **Chairman** inquired whether Mr. Binyon intended to move an amendment.

Mr. **Binyon** would be happy to move—

> "That it is expedient to continue the system of giving prizes in addition to the certificates."

Mr. **Lee** would second the proposition. He believed a money prize would be preferred by the working classes to anything else. He was in favour of money prizes, because they enabled the students to obtain means to aid them in their further studies.

The **Chairman** then put the amendment, which was carried by a large majority.

4. Would the Institutions, at their own Cost, wish to receive, according to a Rota, for Local Exhibition, Collections of some of the more Portable and Useful of the Articles that are Annually Exhibited by the Society of Arts?

The Chairman stated that the Committee of the Yorkshire Union had expressed their opinion in favour of this proposition.

Mr. Chester said the Conference was aware that the Society held annually an Exhibition of inventions patented during the past year. The Council thought it desirable that the Institutions should consider whether they would like to have portions of those Exhibitions packed and sent round to their several localities; but it must be borne in mind that they would have to bear the expense of the carriage. Already, a collection of photographs had been circulated through various parts of the country, and it was the wish of the Council to know whether an Exhibition of the practical nature now suggested would be considered an advantage to the Institutions.

Mr. Barclay Phillips would at once move that such an Exhibition was highly desirable. One Institution which he represented had already availed itself of the facilities afforded by the Society, by holding Exhibitions in the Pavilion at Brighton. The public had highly appreciated those Exhibitions, and they had been attended by between 2,000 and 3,000 persons in an evening. The contributions furnished by the Society had also proved great attractions at the annual *soirées*, and had been found very beneficial in a pecuniary point of view to the funds of the Institution.

Mr. H. W. Freeland, M.P. (Chichester Literary Society and Mechanics' Institute) would second the proposition, which he thought spoke for itself. He was of opinion that in connection with the Institution he represented, it would be an admirable thing to have an exhibition of the kind proposed; but the difficulty hitherto had been the question of expense. He thought if some of those useful models then being exhibited at the Society's House, illustrative of practical inventions, could be sent round to various localities, they would be the means of giving a stimulus to local invention and local effort, and would be of the utmost value. He should be happy to assist as far as he could in carrying out this very desirable object in his own locality, and he hoped the Council would take the subject seriously into their consideration.

Mr. F. Mewburn, jun. (Darlington Mechanics' Institute) was specially instructed to support any proposition by which the Society could, in the way intimated, confer so great an advantage upon the Institutions of the country. In 1855 they had held an exhibition in Darlington, in order to resuscitate the funds of the Institution, which resulted in a clear profit to it of £500. To that exhibition the Society of Arts very materially contributed. The exhibition at Middlesborough had been assisted in the same way; but he was bound to say that some of the photograghs sent were not of so high a character as could have been desired. Speaking of his own Institution, he would say that they would be quite ready to pay the expense of the carriage of really good articles sent for exhibition.

Mr. Robert Hunt stated that he was one of a committee for carrying out, in August next, at Camborne, in Cornwall, an exhibition of mechanical inventions, which should be instructive to the mining population of the district, and he was sure that not only that Institution, but all the others in Cornwall and Devon, would be pleased if they had the opportunity of obtaining from the Society some specimens of the various mechanical appliances that were annually exhibited.

The Chairman remarked that it would be necessary to communicate with the exhibitors, and obtain their sanction before their models could be sent round the country. Of course, nothing could be done in the matter for the present year.

Mr. Talbot was instructed to give his hearty support to this proposition.

Mr. Robert Honey (Huntingdon Literary Institution) said, although hitherto the attempt to form classes for instruction in his Institution had failed, and they had consequently not availed themselves of the Society's Examinations, he was nevertheless prepared to say that they would be very happy to pay the expenses attendant upon such an exhibition as was now proposed. He should support the proposition.

Mr. R. C. Radcliffe thought the plan proposed would materially assist the country Institutions. Blackburn was not behind in mechanical genius; it possessed a great deal of local talent, and various mechanical improvements had originated in that district, but if they could have such an exhibition in their Institution for a few weeks in the year, it would be a great advantage to them. On one occasion Sir Robert Peel had given the handsome donation of £50 towards providing models for exhibition at one of their *soirées*, but an exhibition of the kind proposed would be even of more value than the liberal donation to which he had alluded. Mr. Fothergill Cooke had given two lectures, in the course of which he had introduced several useful inventions, and this had given a great stimulus to the mechanical class of the Institution.

The Secretary would remind the delegates that the carriage of the articles would amount to something very considerable; therefore the Institutions taking them must be prepared to incur a serious expense.

Mr. T. S. Gowing (Ipswich Mechanics' Institution) said there could not be two opinions as to the value of such an exhibition in the provinces. It would, however, be left to the discretion of each Institution whether they would avail themselves of the opportunity afforded for such exhibitions.

Mr. W. O. Field (Gosport and Alverstoke Literary and Scientific Institution) inquired whether any estimate could be given of the expense of the carriage?

The Chairman replied that it was impossible to do so, as of course it would depend upon what was sent. In the event of the Conference being in favour of this proposition, the Council would ascertain next year the feeling of the inventors on the subject.

A resolution affirmative of the proposition was unanimously adopted.

5. Can the Museums and Galleries in the Metropolis which are the Property of the Public, or Subsidised from the Public Funds, be rendered useful to the Institutions in different Parts of the Country, by Systematically Lending to them Specimens for Exhibition, or by Granting to them unrequired Duplicates?

Mr. J. C. Buckmaster (Royal Polytechnic Institution Classes) suggested that this proposition was so similar to No. 4 that it might be disposed of in like manner.

The Chairman remarked that it was notorious that in most of the public Institutions there were a vast number of duplicates, which they would be glad to get rid of, and which would form very valuable exhibitions to be sent round to the provinces.

Rev. J. S. Howson referred to the educational value of such exhibitions as the South Kensington Museum, the Royal Gardens at Kew, the Museum of Practical Geology in Jermyn-street, &c., in which light he thought they ought to be chiefly regarded. All such exhibitions must be looked upon as great aids to education; but in that point of view he thought they were valuable only in proportion as they were permanent. Circulating exhibitions were interesting, but there was the same difference between a circulating museum and a fixed museum, that there was between lectures and lessons. He believed permanent museums might easily be formed in many parts of the country from the duplicates and waste specimens that might be obtained from the great national collections, and they would serve as admirable illustrations of lectures upon the various subjects which those specimens embraced. In the larger towns especially, museums of this character might be readily formed, and courses of lectures might be organised which would render such exhibitions permanently useful.

Rev. T. B. P. Dennis (Bury St. Edmunds Athenæum) thought this a most important matter. He was engaged in the formation of a small museum of geology, and he required a number of specimens illustrative of the older formations of rocks. For that purpose he communicated with the officers of the Geological Museum in London, with a request that they would send him down some specimens of those rocks, but he received no reply whatever to his application. He was convinced that the British Museum had numerous specimens which it would be an advantage to get rid of.

Mr. Robert Hunt remarked that waste specimens as they were termed, particularly of a geological character, would be of no value. They must be selected specimens, and properly classified and labelled, to be of any value for educational purposes. He might mention that as many as forty collections of British fossils, carefully classified and labelled, had been prepared in his department, and circulated amongst the Institutions in the country. In preparing these collections two of the officers of the Institution in Jermyn-street had been closely occupied for six months without being taken off for any other duty. The officers in charge of collections connected with other public departments were prepared to do this to the extent of their means, but with the present staff it was in most cases impracticable. The Society of Arts might do much by urging attention to this subject; at the same time, too much must not be expected, as a very large amount of labour was required to carry this out effectively. He would suggest one thing which the various Institutions might do for themselves, by which they would benefit also the National Institutions, that was—instead of seeking collections from abroad, to form exhibitions of the specimens of interest to be obtained in their own immediate localities — the geology and botany of their own districts. In some few instances where this had been done, very great advantages had been derived. Specimens might be exchanged with the national collections with the greatest advantage, and mutual benefit would thus accrue.

Mr. Chester said he hoped that the Conference was now prepared to convert this question into a resolution unanimously affirmed by the Conference. He agreed with all that had been said by Mr. Hunt on the subject, and he was quite sure he only did justice to the authorities of our various great public establishments, when he stated that it was their desire to make those exhibitions as useful to the public as possible, but he went with Mr. Hunt in the opinion that there was great practical difficulty in getting those exhibitions extended to the provinces. The financial difficulty could only be met by pressure upon the House of Commons, and he advised that petitions to the legislature should be forwarded from the various Institutions, and that their respective representatives should be requested to support them in the house. By that means the necessary impetus to the subject would be given.

Mr. Gowing suggested that exchanges of duplicates might be made with advantage by the Institutions themselves; and such announcements might be made through the medium of the *Journal*.

Rev. W. Lusignan suggested the emendation of the resolution by inserting the word "kingdom," instead of "metropolis."

It having been suggested that the insertion of the words "and elsewhere" after the word "metropolis" would better answer the purpose, the proposition in that form was passed as a resolution by the Conference.

6. Should an Effort be Made by the Union to Procure the Opening of the National Museums and Galleries to the Public of an Evening?

The Chairman stated that application on this subject had already been made by the Council to the Trustees of the National Gallery, and memorials had been sent in by various Institutions. One difficulty that had been raised was the effect of the products of the combustion of gas upon the paintings, and the late President of the Committee of Council on Education had appointed a commission of scientific men to inquire into and report upon the subject. The question, must, therefore, stand over until this Commission had made their report. At the same time it would strengthen the hands of the Council of the Society, if the various Institutions in union sent in memorials upon the subject.

Mr. Chester mentioned that Lord Shaftesbury had moved for the correspondence between the Trustees of the National Gallery and the Council of the Society of Arts, and other bodies who had communicated with them upon the subject, and the Right Hon. W. Cowper had given notice of his intention to bring the matter before the House of Commons immediately Parliament met. It was, therefore, desirable that the Conference should strengthen the efforts that were being made in that direction.

Dr. Ellis considered that if this point were conceded, it would confer a great boon upon the rising generation. During the summer months the objection with regard to the effects of gas would not hold good.

Mr. Pearsall said there was but one opinion in the London Mechanics' Institution as to the desirability of providing elevated and refined recreation for the working-classes in the evening. It would be a great means of stemming the tide of vice in the metropolis.

Mr. F. Mewburn said, although at so great a distance from the metropolis, the Institution which he represented felt so strongly upon the question, that he was instructed to support this proposition. He suggested that the present afforded a good opportunity for a short petition to be drawn up, and signed by the representatives present.

Rev. J. S. Howson felt this to be a social question of the greatest importance. Great mischief was occasioned, in the present day, by places of amusement which had repectable names, but which were, in themselves, only sources of corruption to youth. At Liverpool he believed there would be some difficulty in inducing the municipal authorities to throw open to the public the exhibitions which existed there. At certain periods of the year they were open at a small charge, and they were then visited by the lower classes in great numbers, the more fashionable places of public resort being proportionately thinned. The valuable collection of natural history bequeathed to the town by the late Lord Derby, might be mentioned as an exhibition of peculiar interest, but the objection had been raised that the effects of gas would be prejudicial to the specimens. He hoped the effort which was now being made in this direction, would not be confined to picture galleries alone, but would be extended to embrace all collections of public and general interest. He awaited the report of the scientific commission upon the effects of gas upon pictures with considerable interest.

The Chairman said that he had no doubt, if the object could be effected with regard to picture galleries, other exhibitions of a similar character would speedily afford the same facilities.

Mr. Chester said that the gas difficulty could easily be overcome. The incentive to action upon this subject was afforded by the fact that while the Sheepshanks gallery at the South Kensington Museum had been opened to the public in the evening, with excellent results, the Vernon and Turner collections, which were to be exhibited in adjoining rooms, were to be closed. The Council had represented that, these collections being the property of the nation, the public were not fairly treated unless the access to them was as unrestricted as possible. If it were found necessary, a ceiling of plate glass might be introduced beneath the gas, and thus all risk of damage to the pictures would be avoided. Nothing was more cruel than that with these elevating and rational recreations within their reach, a large portion of the working classes should be confined to amusements of a debasing character.

Mr. Edwin Cockburn (Whitby Institute) said in his neighbourhood they had valuable collections of a geological character, and also a good museum, and if this movement were successful in London, it might be an incentive to the authorities in the provinces to follow in the same course. At present the exhibitions at Whitby were only accessible to the inhabitants upon payment of an admission fee, whilst to strangers free access to them was allowed; consequently, the poorer classes of the town had never visited those places. He had been requested to urge this point, as calculated to give a stimulus to the authorities of private museums in the provinces to follow the example.

A resolution affirmative of the proposition was then unanimously agreed to.

7. Is it Expedient to Apply to Parliament for an Act to extend to the Institutions and to Local Boards the Operation of the Free Libraries and Museums Acts?

Mr. Chester thought the condition of the Institutions generally was not sufficiently advanced to make it desirable to apply at present for an Act of Parliament, giving to Institutions and Local Boards the advantage of support from local rates, as afforded to Free Libraries and Museums under Mr. Ewart's Act; but it was a subject which the Council and the Institutions would do well to keep in view, in order that at some future time the Local Boards and Institutions might be made more independent than they were now. The Council were not prepared with any resolution upon the subject.

Mr. Mathews considered that the power to raise local rates for the building of museums and free libraries ought to be extended to the building of class-rooms for the Local Institutions, and he would say further, that the local rates might fairly be applied in aid of the current expenses of the management of those Institutions. He considered the existing Acts of Parliament ought to be enlarged to that extent. Of course there could be no actual power given to the Institutions themselves, but the assistance must come through the local authorities.

Mr. R. C. Radcliffe rose to elicit information. It would appear that, under the Act referred to, provincial towns had the right of erecting public libraries and museums, which were under the management of the local authorities. If that were the case, he apprehended that considerable damage would arise to Institutions which had libraries, and they would become entirely useless, because, if free libraries were established, the public would have the gratuitous use of them whilst they paid a small fee for the use of the libraries of the Institutions. At present he could not see what advantages the Institutions would derive from the extension of this Act.

Mr. Whitwell (Peterborough) considered that this question ought to include assistance in the erection of public schools. There was a jealousy as to public money being laid out except for strictly public and necessary purposes. Great assistance had been afforded in the erection of schools by the Committee of Council on Education giving an equal sum to that which was raised in the locality for the building of schoolhouses. He thought, however, that where anything could be done by voluntary exertion, it was a pity to call in compulsory aid.

Mr. Blake was of opinion that if Mr. Ewart's act were extended to Institutions, it would never succeed. He believed that in very few towns where free libraries had been established, had they worked well; whilst he thought they were injurious to Institutions. Free museums might be less objectionable, but in 99 towns out of a hundred where they had established free libraries, he believed they had done more harm than good. He proposed that the subject should be postponed.

Mr. Gowing seconded the motion.

Mr. J. C. Buckmaster remarked that it was of very little consequence which way the Conference decided this question. The act would be only a permissive one, and he thought they could very well dispense with it.

The motion for the postponement of the question was agreed to.

8. Is it Expedient that the Society of Arts should Annually Visit some one of the large Manufacturing Towns where there are Institutes in Union with the Society; and if so, under what Circumstances and Conditions should such Visits be made?

Rev. Canon Girdlestone was specially authorised by the Institution which he had the honour to represent to give the most strenuous support in his power to this proposition. He had deeply felt the truth of some remarks that had been made during the present Conference—viz., that the operations of the Society of Arts were not so generally known as they ought to be in the provinces. And he thought this object would be best effected by the means now suggested. He was authorised by his brother Directors of the Bristol Athenæum to state that, if the Council could arrange a plan by which they could pay a visit to Bristol, they would receive a most hearty welcome, and he could assure them that anything the local authorities could do to add interest to that visit and make it profitable to the Society of Arts and the district would be cheerfully done.

Mr. M. Soulsby (Morpeth Mechanics' Institution) thought this proposition was so self-evident that it required no argument to recommend it to the notice of the Conference. He therefore begged, without further comment, to propose the following resolution:—

> "That this Conference anticipates the great benefits likely to accrue to the Institutions in Union from periodical visits of the Society of Arts to certain central towns; and, highly appreciating the considerate reluctance shown by the Society to interfere in the local action and enterprise of the Provincial Institutions, while endeavouring to give a larger development to their common objects and aims, would be loth to impose any conditions or restrictions on those visits, believing as the Conference does that they would be conducted with discretion."

This resolution was seconded by the Rev. Canon Girdlestone.

Mr. Blake spoke in favour of the resolution, and was sure that if the Society came to Yorkshire, the Institutions would do all in their power to render the visit agreeable.

Dr. Ellis said that this was a subject which had been in his mind ever since he had gone with the Society of Arts to the Paris Exhibition. He had remarked the advantages which a connection with the Society gave the visitors on that occasion. Moreover, the Society of Arts was not half so much known as it ought to be throughout the country, and he was sure it only required to be known to be supported as it deserved. The Society, too, could do something very useful to the locality, in return for the compliment of the invitation. Any local exhibition or festive gathering in the provinces would be additionally attractive if honoured by the presence of some of the distinguished members of the Society.

Mr. R. C. Radcliffe apprehended that the object of the Society in visiting the local Institutions would be with a view of improving the position of those Institutions, as well as to further the interests of the Society of Arts. The object would be to bring the Institutions more prominently before the localities. He would suggest that the annual meeting of the Institutions would be a suitable period for the visits of the Society.

Mr. Chester said the Conference must bear in mind that it would be impossible for the Council to send deputations to the anniversary festivals of upwards of three hundred Institutions. The Council had placed this question upon the agenda, because they had already received invitations to visit several places. He wished it to be perfectly understood that if the Society made a visit into the country, it would not have reference merely to educational purposes, but also to the Arts, Manufactures, and Commerce connected with the particular district visited. If the Conference were of opinion that this question should be further considered by the Council, they would be happy to do so, and if invitations were received, they would decide upon the locality to be visited, and they would select that town in which their visit might be most useful to the objects they had in view.

Mr. Robert Edwards (London Tailors' Labour Agency Literary Institute) said he did not see what the visits of the Society could do for those Institutions which were in so languid a condition that they wanted some extraneous aid to excite popular sympathy. The great bane of the Institutions generally had been that they had been converted from the useful purposes for which they were intended, into mere places of amusement. He feared the visits of the Society could do little towards resuscitating the decayed Institutions, of which there were many. He thought they might safely leave this subject to be determined by the Council.

Mr. Pearsall objected to the word "manufacturing" which was used in the proposition put forward by the Council, as describing the towns which the Society should visit, because he thought this restrictive character undesirable.

This view was supported by Mr. Whitwell, Mr. Barclay Phillips, the Rev. Canon Girdlestone, and other gentlemen, it being explained that this word did not occur in Mr. Soulsby's resolution.

Mr. Wm. Hawes thought something was to be said in favour of manufacturing towns only being selected for the visits of the Society, as its objects were so intimately associated with Arts, Manufactures, and Commerce.

The Chairman remarked that if they restricted the visits to manufacturing towns only, the greater part of the West of England would be excluded.

Mr. Chester thought if the question was to be restricted, they had better abandon it altogether. Liverpool was a commercial town, and not a manufacturing town; and the same might be said of Brighton and other large towns. He recommended them to make the question as open as possible, and to leave the Council unfettered in the choice of the locality to be visited.

The resolution was then carried.

9. Do the Institutions Agree with the Council in thinking it desirable to provide at the House of the Society Facilities for the Admission of Members of the Institutions, Visitors in London, to the different Establishments and Objects of Public Interest Accessible Gratuitously by Tickets, and for Seeing which much Curiosity is usually felt by Strangers?

The Chairman explained that the Council had already had this subject under consideration, and were in communication with various establishments for the purpose of affording to members of Institutions in Union the facilities referred to. The Council had already received tickets for the Museum of the East India Company, for Windsor Castle, the United Service Institution, and other establishments, and the Master of the Mint had communicated his readiness to issue tickets for his department, although from the nature of the work carried on, this privilege could only be occasionally afforded.

The proposition was unanimously affirmed.

Mr. W. Mathews, jun., said he wished to draw the attention of the Council to some points in one or two of the Examination papers, which appeared to differ from the Programme.

The Chairman intimated that as this was a subject which could not be dealt with by the Conference, Mr. Mathews had better communicate his views to the Council in writing, which that gentleman promised to do, and the matter dropped.

The Chairman read the following resolution, of which Mr. Buckmaster had given notice of motion;—

> "That the Evening Classes for systematic instruction in Mechanics' Institutions and similar bodies, ought to be at liberty to receive grants from the Committee of Council on Education on the same terms as the Evening Classes connected with inspected Day Schools."

Mr. J. C. Buckmaster having expressed his sense of the importance of this subject, and having alluded to the absence of gentlemen whose support he had expected to receive in the discussion of it, proceeded to remark that he hoped this question would be considered in a liberal and generous spirit. It would be necessary for him briefly to review the progress of elementary education in this country, and its general bearing upon Mechanics' and other Institutions, as means for secondary education. In 1846, the minutes of the Committee of Council on Education came into operation; under those minutes grants were made in aid of school buildings and the purchase of educational apparatus; there was also an organisation for training schoolmasters and schoolmistresses and for the apprenticeship of boys as pupil teachers. A system of inspection was also adopted and annual reports were submitted to Parliament of the characteristic features of this scheme of education. The introduction of those minutes was carried by only a small majority in the House of Commons, the proposal having met with a most vexatious opposition.

Mr. Chester begged leave to correct the speaker upon a matter of history. It was not in 1846, but in 1839, when the Committee of Council on Education was first established, that the opposition to which Mr. Buckmaster alluded was made.

Mr. Buckmaster went on to remark, that anything like a national system of education had always met with considerable resistance, although they would all agree that from 1846 to the present time none of the evils so freely predicted had resulted from the operation of those minutes, but that elementary education in this country had made great progress under great difficulties, and that the standard of the teachers had been considerably raised. It was true that the children were taken from school frequently at the early age of ten years, when they were scarcely able to read or to scrawl their own signature, and were put to work and thrown into the company of men of sensual and intemperate habits. The consequence was that in many districts they had a population passing away, succeeded by one not much more intellectual or more virtuous than that which had preceded them. In order to remedy this state of things several methods had been suggested by the friends of education. He would only advert to two of these as connected with the present discussion—the introduction of the Factory Act and the establishment of evening classes. The introduction of the half-time system into towns and agricultural villages would be attended with great difficulty. Although this system had been in operation for a number of years in the manufacturing districts, yet he knew of no instance in which the friends of education or the employers of labour had voluntarily agreed to try it elsewhere. But evening instruction was on the increase. In the north and north-west parts of England it was carried on to a very considerable extent, and he was happy to say, from personal observation, it was carried on in this great metropolis to a larger extent than was generally imagined. The instruction was in most cases of a purely elementary character, although in some instances the education was of a more advanced description, as was shown in the results of the last Examinations. If an evening school was established in connexion with a day school under inspection, upon application to the Privy Council on Education, a grant of £10 a year was made in aid of the salary of the teacher. It was not necessary that the master of the evening school should be the master of the day school, nor was it necessary that he should be a certificated master. The only condition was, that he should be considered competent to give the instruction required, and that he should not be under 18 nor above 40 years or age. But when it happened, as was very often the case, that the master of the day school was also superintendent of the evening school, then the duties of the day school devolved partly upon an assistant-master on the days when the teacher was to be engaged in the evening instruction. Although this system came into operation in 1855, only a few schools had availed themselves of this advantage; and what was more extraordinary was, that whilst these evening schools, in many instances, had a small and meagre attendance, the pupils at the evening classes of Mechanics' Institutions had been greatly on the increase. He would speak of Macclesfield and Sheffield, where the attendances at the classes of the Institutes had been more than twenty times larger than the attendances at the evening schools in connexion with the Government day schools. One cause of this was, the poor accommodation afforded in the children's schoolrooms. But there was still a greater difficulty than that —and he should not be doing justice to that class to which he properly belonged, and in connexion with which his sympathies and opinions were very strong, did he not say that the denominational character of the education was one great reason why the education given in evening classes connected with inspected schools was not more generally taken advantage of by the working classes. There was also one other difficulty attached to the system, and that was, that the day school and the evening school were alike managed by the same denominational committee, and all the educational grants were made through those committees. He saw no good reason why the operation of those grants for education should not be extended to classes in connexion with Mechanics' Institutes. He would be the last man to ask the Conference to cooperate with him in asking for that help, if he felt satisfied that the working population were in a condition to do what was required efficiently for themselves. It had never yet been done in any country that he knew of, and the difficulties in connexion with its being done in this country were very great; and, however much the Institutions had changed in their character and object, they must not forget that they were called into existence by the spontaneous feeling of the working classes of a great educational want. He was not an advocate for the abandonment of those lectures and concerts which the Institutions must have if they would keep up their funds, but they must not delude themselves with the idea that they were doing a great educational work when they had lectures upon such subjects as Wit and Humour. What they wanted was comfortable class rooms, superintended by competent teachers. If they had any faith in education—if they believed it made a man less sensual and less vicious—and if they had any belief in the promises made to those who exerted themselves in the cause of education, he was sure this Conference would support the resolution of which he had given notice, and which he now begged to propose.

The Chairman again read the resolution, and mentioned that the Yorkshire Union had expressed themselves in favour of it.

Mr. Blake said in supporting this resolution he did not go to the whole extent of Mr. Buckmaster's argument. It was to be remarked that these evening schools were placed in direct competition with the evening classes of Mechanics' Institutions, and at the same time they did not do the work so well or so efficiently. Upon a consideration of the whole subject, he thought if the Committee of Council on Education extended their aid to the classes of Mechanics' Institutions under proper restrictions, by furnishing competent teachers and establishing classes, the Institutions in the country would derive considerable benefit from such grants.

Rev. J. S. Howson said, that in the report of the East Lancashire Union of Institutions he found a passage to the effect that the Committee had afforded aid to evening classes connected with that Union. He had no doubt that if this had been done in one case, the principle might be extended. If Sir James Kay-Shuttleworth had obtained that grant in the case of the East Lancashire Union, they need not despair of an extension of the privilege.

Mr. Harry Chester said although he was not now officially connected with the Committee of Council on Education, he was sufficiently acquainted with the circumstances to be able to give an explanation. It was quite true, as stated, that Lord Granville and the Right Hon. William Cowper made the grant to the East Lancashire Union of Institutions, and had the same ministry remained in office, he had no doubt the privilege would have been extended. In the case of the East Lancashire Union, the grant was made by way of experiment. The idea was that any Union thus aided should be so small that the educational operations could be effectually directed from one centre; but the succeeding Government decided not to extend this privilege. The result was that the law remained as Mr. Buckmaster had stated, and no school could receive the grant in which the Bible was not read daily, and which was not subject to inspection. The question which had been brought before them was one of the largest character, and which they could not pursue satisfactorily at that late hour of the day. There was, moreover, the danger that if the Government could be persuaded to extend the area of their operations in this respect, when they came to the question of re-imposing the additional income-tax, the general grants for education might be rejected or seriously reduced. He thought there was a great distinction between grants to schools in which children were educated and those in which the instruction was confined to adults; and his belief was, that although the country was prepared to view with approval the extension within reasonable limits of assistance in the education of children, yet, when it came to the question what retrenchment should be made, any grants which referred to the education of adults would have to be given up.

Mr. Mathews said his Institution was of opinion that grants in aid of the evening classes of Mechanics' Institutions should be made under similar regulations to those connected with the evening schools of inspected day schools. They saw no reason why the Government grants should be confined to establishments for juvenile education. He thought that at present, however, there was very little chance of that extension being made, because the grants for educational purposes had so much exceeded what had been originally anticipated.

Mr. Gowing said, after consideration of this subject by the Committee of his Institution, they were in favour of a grant being made in aid of the salaries of teachers in the evening classes of Mechanics' Institutes; but he warned them against asking for grants upon the same terms as they were given to day schools, because that would involve the right of inspection, and he did not think this could be submitted to.

Mr. Binyon proposed, as an amendment, that the subject be adjourned until the next Conference, or, if it was put to the vote, he should feel compelled to hold up his hand against the proposition of Mr. Buckmaster. His own experience had shown that working men were decidedly averse to interference of any kind in such matters, and he thought, in many localities, the mere fact of the classes for instruction being aided by Government would cause them to cease to exist. He thought such grants would be only holding out a premium to Institutions to get into a state of insolvency, in order that Government assistance might stand in the place of personal exertion. He moved that the subject be postponed till the next Conference.

The Chairman having suggested that the original resolution had not been seconded,

Mr. Lee seconded the resolution of Mr. Buckmaster. He was of opinion that many Institutions with which he was acquainted, and which had been broken up, would have been successful if they had been judiciously assisted in their younger days. If they were afraid of being inspected let them not apply for the aid. The Institution which he represented considered that the aid of the Government ought to be accepted in the matter of teachers, if in nothing else, as the majority of the Institutions could not afford to pay the salaries of good instructors.

Mr. Wm. Hawes was of opinion that the best mode of meeting this question was by postponing it; for this reason, that the resolution was not sufficiently definite to divide upon. The two subjects—the education of the young and the education of adults had been mixed up together. He believed the system of personal effort and exertion was the proper one to be kept in view with regard to adult education; but with reference to juvenile instruction the attendance at the schools was to a great extent compulsory on the part of the children. He begged to second Mr. Binyon's amendment.

Mr. Buckmaster said he intended to divide the Conference upon this question, believing as he did that if it was postponed, it would be just in the same position this time twelvemonths as it was now. The Government had recognised the principle of giving assistance to adult instruction by the grants which were made to the evening schools in connection with inspected day schools. From his personal observation and experience he was convinced that the working population of the country were not able to pay sufficient to secure efficient and good teachers.

Mr. Barclay Phillips, as representing four Institutions, would say that they had not considered whether they would like "the small end of the wedge" inserted in the way proposed. It involved a great political question, and would doubtless give rise to a great deal of polemical discussion.

After some further conversation, the amendment was put, and carried by a large majority.

Mr. Noldwritt (Walworth Literary and Scientific Institution) called attention to the last List of Lecturers issued by the Society, and took exception to some of the subjects upon which lectures were announced.

A brief conversation ensued, in the course of which it was stated that the list was intended merely as a Directory of Lecturers, and that the Society itself passed no opinion upon the merits of the lecturers or the subjects upon which they lectured.

Mr. Mathews offered a few remarks upon the subject of the rating of Institutions. As regarded the Institution which he represented, they had a special clause in the Local Act for exemption from parochial rating, otherwise the Institution would be brought to ruin. It was assessed at £600 per annum, and the local rates amounted in the aggregate to 6s. 8d. in the pound. This would make a sum of £200 out of an income of about £500 a year, which was barely sufficient to carry on the business. The Institutions in the country looked to the Society of Arts to protect them from this injustice, and they hoped that if a bill was introduced into Parliament, the Society would use every exertion to obtain the removal of the objectionable clauses which were contained in the last bill.

Mr. Blake remarked that the two gentlemen whose names were on the back of the bill were favourable to the exemption of Institutions from rating; the only difficulty was to define what should be considered an Institution. The bill that was withdrawn upon the last dissolution contained many great inconsistencies. If the bill was again brought forward he thought they might rely upon the Society giving timely notice to the Institutions, as well as exerting itself to prevent the commission of such an injustice.

A cordial vote of thanks was then passed to the Chairman, for his able presidency over the business of the Conference, and the meeting adjourned.

HORTICULTURAL SOCIETY OF LONDON.

A special meeting of this Society was held yesterday, in the Great Room of the Society of Arts, the Earl of Ducie, V.P. of the Horticultural Society, in the chair. The following report from the Council of the Horticultural Society was read :—

The Council of the Horticultural Society have thought it desirable to call the present Special Meeting of its members, in order to explain the steps taken by them with a view to obtaining a locality in the immediate neighbourhood of the metropolis, where some of the objects of the Society might be pursued on a large scale with great advantage. They now proceed to state their views for the future, in the confident hope that the course which they think it their duty to recommend for the future adoption of the Society, will meet with its hearty approval and concurrence.

It is scarcely necessary to recur to the reasons which led the Council to the conclusion that it was inexpedient to continue the annual exhibitions at Chiswick. Successful and attractive as those exhibitions once were, it seemed evident to the Council that it would not only be to the pecuniary advantage of the Society, but that their means of usefulness as a scientific body would be greatly extended, if they could obtain sufficient space for the prosecution and development of their objects in the more immediate neighbourhood of London.

In seeking for such a situation, the attention of the Council was naturally attracted to the finely situated estate purchased by the Commissioners for the Exhibition of 1851, out of the surplus proceeds of that Exhibition; and it appeared to them that the grant by the Commissioners of a certain portion of the estate to the Society would be strictly compatible with, and might even tend largely to promote the means of encouraging Art and Science generally, the furtherance of which was known to be the object for which the Commissioners were incorporated by Royal Charter.

The Council of the Society, therefore, some time since made an application to the Commissioners of 1851, in order to ascertain how they would be disposed to regard a request from the Horticultural Society for permission to establish itself upon their estate.

The Commissioners have met this request in a liberal spirit, and it will be the duty of the Council to lay before the present meeting the conditions on which the Commissioners have announced their readiness to comply with it.

It may be as well, however, first to point out the situation of the estate, and more particularly of that portion of it which the Commissioners are willing to place at the disposal of the Horticultural Society.

After letting on building-leases certain outlying portions of their estate, the Commissioners have reserved about fifty acres for the purposes of their incorporation, forming a parallelogram between the two new roads: Prince Albert-road (one hundred feet wide) to the west, and Exhibition-road (eighty feet wide) to the east; which two roads connect the Kensington-road on the north with the new Cromwell-road (eighty feet wide) on the south. Of this parallelogram, the Commissioners have reserved a portion of about sixteen acres at the south end for the purposes of the Great International Exhibition which had been projected by the Society of Arts for the year 1861—the intention of holding which has, it is hoped, been but temporarily suspended by the war now unhappily raging; also a portion at the North end, with a frontage to Hyde-park well adapted for any public buildings which it may hereafter appear desirable to erect there; and further spaces of about one hundred and fifty feet in depth along each of the parallel roads running north and south, for such buildings, public or private, as the Commissioners may hereafter, in the prosecution of their own objects, determine to erect.

It is the remainder or centre of this ground that the Commissioners, under certain conditions, have offered to place at the disposal of the Horticultural Society. This space, inclusive of a proposed Winter Garden, and also of Italian arcades with which the Commissioners themselves propose to surround it, will contain about twenty acres available for the new garden of the Society.

The conditions on which the Commissioners have made their liberal offer will be communicated in the course of the meeting. The main provisions are, that the Society shall engage to lay out and maintain the garden in a fitting style, and that it shall also erect a conservatory, or Winter Garden—the whole at a cost estimated at £50,000, and should the offer be accepted, the Commissioners will be prepared to grant the Society a lease of the ground for thirty-one years, and further, as before stated, to surround, at their own expense, the space allotted for the garden with Italian arcades open to the grounds and built at their own expense at an estimated cost of £50,000; the conditions as to the payment of interest on any sum so expended not exceeding £50,000, and as to the amount of rent to be paid by the Society, being of the most liberal nature.

The great advantages of the site proposed are obvious The garden will be in the immediate neighbourhood of Hyde-park and Kensington-gardens, and in the very centre of a new and rapidly rising town of first-class houses which bid fair to become one of the most popular and fashionable districts in London. The shape and situation of the ground, which slopes gradually from the north to the south, admits of the formation of successive terraces on different levels, affording peculiar facilities for effective and ornamental treatment, and is well adapted besides for the effective display of sculpture; while a fine Winter Garden at the upper end, and a colonnade extending round it will afford a promenade of three-quarters of a mile in length, sheltered from heat and cold, wind and wet. The Colonnade will also offer peculiar facilities for the display of the flowers and fruit at the Annual Shows, free from all those risks of weather which have not unfrequently marred the Chiswick Fêtes.

Bearing all these advantages in mind, the Council have no manner of doubt that, with the hearty support and cooperation of the Royal Commissioners which have been so liberally promised to them, they will be enabled, while keeping steadily in view the scientific objects of the Society at Chiswick, to make this garden, with the periodical Exhibitions which they propose to hold in it, one of the most attractive places of popular resort in the neighbourhod of London; and they will have the satisfaction of knowing that they have provided for the metropolis a place for healthful recreation during the more inclement season of the year.

Plans and designs for the Winter Garden, and for laying-out of the ground, as prepared and agreed upon in conjunction with the Royal Commissioners, are now hung up in this room, and a careful estimate of the probable cost has convinced the Council that, as at present prepared, these plans may be carried into effect for the sum named. But it should be borne in mind, that the more liberal the support which the Society shall meet with, and the nobler the scale on which the designs for this garden are framed and executed, the greater will be the prospect—not to say the certainty—of a successful and remunerating result.

Should the General Meeting adopt the views of the Council, the question will then arise as to the mode of raising so large a sum as £50,000.

The Council believe that this may be effected by the issue of a certain number of Life Memberships; but as the success of the undertaking will in some measure depend upon the vigour with which it is undertaken, and it is of importance that the works should not be in any way delayed in their completion, if once determined on, it will be requisite to obtain the money immediately required for the progress of the works by the issue of debentures, bearing interest at five per cent., to be redeemed as the receipts for Life Memberships become available. Donations in aid of the undertaking will at the same time be thankfully accepted by the Council, and they will be prepared to extend to the donors of sums exceeding twenty guineas, privileges similar to those possessed by members. Had the Council been inclined to make the project a mere commercial speculation, and to place it in the hands of a company, there is little doubt that thrice the sum now demanded would have been speedily obtained. But the Council felt that such a course would have been derogatory to the character and objects of the Society; nor would the support and co-operation of the Royal Commissioners of 1851 have been extended to such a mere money speculation. They, therefore, prefer resting their hopes of success in the course proposed, and in the desire which will be generally felt to promote the accomplishment of a scheme so advantageous to the Fellows and the public, and so conducive to the important objects for which the Society was chartered; and they entertain no doubt that their confidence in the support of the public will be justified by the result.

The Council propose to keep up the experimental part of Chiswick Gardens, and also so much as may be required to furnish decorative plants for the new garden at Kensington Gore.

The Duke of Leinster proposed a resolution instructing the Council to proceed further in their negotiation with the Royal Commissioners. This was seconded by Mr. Pownall, and passed.

Mr. C. Wentworth Dilke announced that he had been commanded, should the meeting decide upon trying to obtain the Garden at Kensington Gore, to deliver in the following letter from Sir Charles Phipps, expressive of the intention of Her Majesty, H.R.H. the Prince Consort, and other members of the Royal Family, to give their support to the undertaking:—

Buckingham Palace, July 7, 1859.

My Lord,—I have received the commands of Her Majesty the Queen, and of His Royal Highness the Prince Consort, to inform you that in the event of the plan being carried out for the establishment of the Garden of the Horticultural Society of London upon the estate at South Kensington belonging to the Royal Commissioners of the Exhibition of 1851, it is the intention of Her Majesty and of His Royal Highness to make donations towards the execution of this undertaking, of one thousand pounds (£1,000) and five hundred pounds (£500) respectively.

It is also the intention of Her Majesty, should it be in accordance with the rules of the Society that parents or guardians should purchase life memberships for children or persons not yet of age, to place the name of His Royal Highness the Prince of Wales, and the younger Princes and Princesses upon the list of life members.

I have further the pleasure of informing your lordship that I am authorized by Her Royal Highness the Princess Frederic William of Prussia, Princess Royal of England, to announce the intention of Her Royal Highness to become likewise a life member.

I have the honour to be, my Lord,
Your lordship's most obedient, humble servant,
C. B. PHIPPS.

The Earl of Ducie.
&c., &c., &c.

Drawings and Plans of the proposed Garden were suspended on the walls of the room, as well as a series of Photographs of Roman Arcades, the erection of buildings of this character forming one of the features of the undertaking.

These will remain at the Society's house for some days, and will be open to the inspection of Members of the Horticultural Society, as well as of Members of the Society of Arts and their friends.

UNIFORM MUSICAL PITCH.

The following letter has been addressed to the Chairman of the Musical Pitch Committee :—

Sir,—I regret that it was not possible for me to attend the meeting of the Society of Arts on the subject of a fixed musical pitch or diapason; but understanding, from the reported proceedings of the meeting (as, indeed, might have been reasonably expected), that a Committee has been formed to consider the subject more deliberately than could be done in a general meeting, I beg leave to offer my opinion in the form of a letter.

The subject is extremely simple in itself. All are agreed that the present pitch is inconveniently high and *must* be lowered. All are desirous that, when once lowered, it should be kept from rising again, to which there is a continual tendency, arising from a distinct natural cause inherent in the nature of harmony, viz., the excess (amounting to about eleven vibrations in ten thousand) of a perfect fifth over seven-twelfths of an octave, which has to be constantly contended against in upward modulations, whenever violins or voices are not kept in check by fixed instruments. But perhaps all are not aware that the evil of fine ancient vocal compositions having thus been rendered impracticable to singers in their original normal key is a very great one, inasmuch as transposition to a lower nominal key involves the sacrifice of the adaptation of the peculiar character of the key (a character intended and felt by the composer), and the substitution of a totally different incidence of the temperament on the series of notes in the scale, and goes, therefore, to mar the intended effect and injure the composition, as much as an ill-chosen tone of varnish would damage the effect of a fine Titian.

Since, however, all are agreed that the pitch must be lowered, the only remaining question is, how much? Now, if there were any prospect that this operation which has now to be performed, and which our French neighbours consider themselves to have performed, could be repeated some twenty years hence, I should be disposed to acquiesce, for the mere sake of acquiescence, in the conclusion they have come to, viz., to fix A (for the present) at 870 vibrations per second, which is equivalent to fixing C at 522, looking forward to a future step in the same direction which should bring it to 512; there to remain henceforward invariable. Such a C, being the ninth octave of a fundamental note corresponding to one vibration per second, has a claim to universal reception on the score of intrinsic simplicity, convenience of memory, and reference to a natural unit, so strong that I am amazed at the French not having been the foremost to recognize and adopt it, when it is remembered that their boasted unit of length, the metre, is based on the subdivisions of a natural unit of space, just as the second (a universally used aliquot of the day) is of time; the one on the linear dimensions, the other on the time of rotation of the earth.

But as there is not the least chance that the present move will be otherwise than final, I confess myself disposed in this matter to be more French than the French themselves; to act once for all; to adopt the C of 512 vibrations, and so to carry out this as part and parcel of a complete natural metrical system, which would recommend itself to all nations on its own merits, while possessing the additional and not inferior merit of meeting more fully than the half-measure proposed, the wishes of the singer, and the requirements of that most perfect and charming (because most naturally affecting the feelings) of all instruments, the female voice: which I consider, in any discussion of the kind, ought to be held paramount to any possible claim on the part of wood, brass, wire, or catgut. It is clearly the interest of any lover of music that the pitch should be such as can be maintained by a vocalist, not merely in her highest vigour of youth, but up to an age when the voice, though still perfect, and, in fact, improved and mellowed by time and practice, is yet unable, without painful effort, to reach the extreme elevation it could accomplish without difficulty at an earlier period.

If a change be made, I do not believe the instrument-makers would find their interests at all more or less affected whether the pitch were lowered to, and permanently fixed at, 522 or 512. In either case, they would stand disembarrassed at once and for ever of the necessity of consulting the varying convenience or caprice of their customers in different places, and it must (assuredly it ought) to be to them a matter of perfect indifference what the requirements of the public in that respect may be. As to what is alleged of the superior brilliancy and "sonority" of instruments pitched a comma or two higher than others, I regard it as mere professional jargon, unworthy of the slightest consideration.

I will add only one further remark. The 512 C is independent of any standard of length or of the velocity of sound. It has nothing to do (as seems to have been assumed in one of the letters read to the meeting) with 32 feet as the length of an organ pipe, supposed (but very erroneously) to yield its fourth lower octave. If we would introduce extraneous considerations of this kind, we might take as a fundamental unit, on the French metrical system, a wave-length of one metre, or its binary multiples or submultiples. This would give (taking the velocity of sound in dry air at the freezing temperature at 1090 feet) an E of 664·4 vibrations for the nearest approach to the new French E, corresponding to an A (tuned as a fourth above it) of 886 vibrations, the difference between which and the French standard lies in the wrong direction, and which coincides exactly with the Bordeaux pitch, as stated in the reports of the French commission. Again, if we take the velocity of sound at the British standard temperature (62°) at 1,124 feet or 342·6 metres, we shall be led to an F of 685·2 vibrations, corresponding to an A of 856, and a C of 514, a very near approach indeed to our own proposed C.

Or again, if we combine the British standard yard as a wave length, with a velocity of 1109·6 feet per second, corresponding to the mean temperature 49·27 Fahr. at Greenwich, so as to get a purely British fiducial note, we are led to an F sharp of 739·7 vibrations, corresponding to a C of 526, which, though nearly approximating to the French C, lies above it, and is on that account objectionable. As the origin of a musical system, moreover, it would be an anomaly to take as the fundamental (or, more properly, fiducial) note of the diatonic scale the sharpened fourth of its key note. And a similar objection, *mutatis mutandis*, lies against both the former modes of derivation. Theoretically speaking, also, as the mean velocity of sound varies in different climates, all such modes of humouring or cooking a fundamental note into conformity with a predetermined result must be condemned.—I am, &c., J. F. W. HERSCHEL.

Collingwood, June 14, 1859.

Home Correspondence.

GUM FROM CEDAR.

Sir,—A gentleman who has made a collection of 600 specimens of marbles, had them polished. They are 2 inches by 3 inches, and from a quarter of an inch to half an inch thick. He has had a handsome cabinet made for them—the drawers the depth of each piece, and nothing more, so that they almost touch the under side of the drawers above, which are of cedar. After those marbles had been in the drawers for a short time they became covered with gum, and stuck to the fingers. They were cleaned, and the same took place again. A friend, who is a collector of minerals, &c., informed me that he had drawers of the same wood made eleven years ago, and to this day the same effect takes place, although he papered his drawers. Can any of your scientific friends find out a remedy?—I am, &c.,

Richmond Hill, Liverpool. WM. BROWN.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 20, 21, 23 *April*, 2, 4, 5, 7, 11, 16, 19, 21, 25, 26, 28 *May' and* 2 *and* 7 *June*, 1859.

Par.
Numb.
213. Army, Ordnance, and Navy—Return.
223. Belvoir Agricultural Model School—Return.
217. Cambridge University—Copy of Statutes.
227. Reformatories, Schools, &c.—Return.
236. Army (Divine Service)—Return.
162. East India (King of Delhi)—Return.
164. Increase and Diminution (Public Offices)—Abstract of Accounts.
218. Income Tax (Dublin)—Return.
233. Militia Volunteers—Return.
237. East India (Sir James Outram)—Copy of Minute.
267. Pasteboard Makers—Return.
68 (3). Trade and Navigation Accounts—(31 March 1859).
209. Royal Indian Military College, Addiscombe—Regulations.
210. East India (Education)—Copy of Despatch.
212. East India (Punjab)—Return.
229. Greenwich Hospital—Account.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 1st*, 1859.]

Dated 28th April, 1859.

1064. J. Kidd, Birkenhead, Chester—Imp. in sewing machines.

Dated 15th June. 1859.

1438. E. Humphrys, Deptford, Kent—Imp. in marine steam engines.

Dated 16th June, 1859.

1446. N. C. Szerelmey, 6, Park-terrace, Brixton-road, Surrey—Imp. in preparing combinations of materials for preventing rust in iron and other metals, and decay in timber.

Dated 18th June, 1859.

1467. J. Luis, 1B, Welbeck-street, Cavendish-square—A new system of windmill. (A com.)
1468. J. Cox, Wenlock-road, City-road—Imp. in machinery or apparatus for cutting rags for paper makers.
1469. A. Jeffery, Commercial road, Limehouse—An improved mode of giving rotary motion to projectiles fired from rifled firearms.
1470. R. Bradshaw, Camden-town—Imp. in rotary steam engines and pumps.
1471. R. Harper, R. Stokes, and T. Walker, Derby—An imp. in the manufacture of chenille bonnet wreaths and bonnet feathers.
1473. G. J. Parker, Church-street, Stoke Newington—A self-acting apparatus for giving alarm of fire, which is also useful in checking the same.
1474. W. Clark, 53, Chancery-lane—An improved method of supplying furnaces with hot air. (A com.)
1475. P. F. Aerts, London—Improved apparatus for lubricating railway rolling stock, and the moving parts of machinery.
1476. J. Ransley, 19, Princess-terrace, Islington—An improved brake for retarding railway and other carriages.
1477. J. Ransley, 19, Princess-terrace, Islington—An improved omnibus.

Dated 20th June, 1859.

1479. J. Cox, Birmingham, and S. F. and M. Frankham, Walsall, Staffordshire—Certain imp. in spurs for military and general use.
1480. R. Laming, Hampstead—Imp. in purifying gas, and in obtaining and reproducing materials useful for that purpose.
1481. C. L. J. Dierickx, Paris—Imp. in coining.
1482. J. Edwards, 77, Aldermanbury, London—Imp. in the manufacture of iron rails.
1483. A. V. Newton, 66, Chancery-lane—Improved apparatus for blowing off water from steam boilers. (A com.)
1484. A. J. Hawkes, Jewin-crescent—An improved triturating apparatus.
1485. W. Rowan, Belfast—Imp. in the generation of steam.
1486. T. C. Clarkson, 56, Stamford-street, Blackfriars—Imp. in the manufacture of boots, shoes, and other articles.

Dated 21st June, 1859.

1487. A. P. How, 81, Mark-lane—Imp. in self-supplying distilling apparatus, and in apparatus for cooking combined therewith.
1489. E. Gwyn, Islington—Imp. in breech-loading fire-arms. (A com.)
1491. W. E. Newton, 66, Chancery-lane—An imp. in tailors' and other shears. (A com.)
1493. A. Parkes, Birmingham—Imp. in the manufacture of cylinders and tubes of copper, and alloys of copper.

Dated 22nd June, 1859.

1497. R. Smith, Longridge, near Preston, Lancashire—Imp. in apparatus applicable to looms for weaving fancy fabrics.
1499. A. Barclay, Kilmarnock, Ayr—Imp. in steam hammers and pile driving machines.
1501. C. Clarini, New York, U.S.—Making wrought metal nails by machinery.
1503. F. X. Kukla, 121, Pentonville-road—Imp. in projectiles.
1505. T. Moore, Lupus-street, Pimlico—Imp. in knapsacks and mess tins.

Inventions with Complete Specification Filed.

1444. L. Barroux, 10, Rue Mogador, Paris—A new system of railroad, supported on iron soles, with or without wood being used.—16th June, 1859.
1451. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved kiln for brick and plaster burning. (A com.)—16th June, 1859.
1453. E. A. Cutler, Connecticut, U.S.—A new and useful machine for making horse shoes. (A com.)—16th June, 1859.
1500. G. T. Bousfield, Loughborough-park, Brixton—Imp. in apparatus for winding thread of cotton or linen, or other fibrous materials, or sewing silk, or similar articles, upon bobbins or spools. (A com.)—22nd June, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, July 1st*, 1859.]

July 1st.

17. J. Harris.
19. G. Skinner and J. Whalley.
29. W. Renton, T. Renton, and W. Binns.
33. J. B. Joyce.
34. W. Hood.
35. A. Bedborough.
36. C. de Forest.
38. W. Draper.
47. W. Renton, T. Renton, and W. Binns.
51. W. Spence.
79. E. Agneni.
97. T. Elwell.
130. P. A. Viette.
150. H. Gallon, J. H. Bean, and S. Lumb.
168. J. H. Johnson.
258. C. E. Amos and J. Francis.
312. S. D. Davison.
314. M. Smith.
884. W. E. Newton.
962. H. H. Vivian, M.P.
1056. J. Stuart and W. Stuart.
1136. J. H. Johnson.
1144. J. Frearson.

[*From Gazette, July 5th*, 1859.]

July 5th.

42. W. Corfield.
48. J. Aspinall.
52. I. Holden.
54. J. J. Florance.
60. H. Harden.
78. T. H. Toms.
148. J. Foster.
190. C. O'Hara.
198. B. Lauth.
210. R. Mushet.
251. E. T. Hughes.
294. E. H. Bentall.
372. W. E. Newton.
910. W. Clark.
1040. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, July 1st*, 1859.]

June 29th.

1582. T. Smith.
1608. A. V. Newton.
1623. A. W. Williamson.

[*From Gazette, July 5th*, 1859.]

July 1st.

1559. W. H. Hubbard.
1572. R. L. Howard.
1594. J. Horsfall.

July 2nd.

1591. G. Sampson.
1597. E. C. Healey & E. E. Allen.
1632. P. Prince.
1635. J. Fowler, jun., and W. Worby.
1720. R. Richardson and J. E. Billups.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4180	June 14.	Economic Gas Regulator	Henry Spence	33, Great Charles-street, Birmingham.
4181	,, 15.	Cottam's Ventilating Manger Fittings ...	Cottam and Company ...	2, Winsley-street, Oxford-street, W.
4182	,, 16.	Universal Advertising Medium	The Permanent Advertising and General Agency Company, Limited	78, Gracechurch-street, E.C.
4183	,, 17.	Safety Hunter's Shoe...	James Heavens	28, South Molton-street, London, W.
4184	,, 24.	Improved Cheesemaking Apparatus ...	James Cornes	104, Pool-square, Sheffield.
4185	,, 27.	The Engraver's Assistant	Henry Naylor	Barbridge Works, near Nantwich.
4186	,, 29.	Stud Button Shank	John William Scott	Victoria House, Worcester.
4187	July 1.	Draw Spring for Ships' Cables and Towing Lines	Cuthbert Harrison Thew ...	Whitehaven.
4188	,, 4.	An India Rubber Tobacco Pouch	John William Mott	Lea Bridge-road, Clapton, N.E.

Journal of the Society of Arts.

FRIDAY, JULY 15, 1859.

COUNCIL MEETING.

At the first meeting of the Council, since their election, Sir Thomas Phillips, F.G.S., was unanimously elected Chairman for the current year.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following is the second* letter addressed by the Council of the Society of Arts to the Trustees of the National Gallery :—

Society for the Encouragement of Arts, Manufactures,
and Commerce,
Adelphi, London, W.C., May 30, 1859.

Sir,—I have submitted to the Council of the Society of Arts your letter of the 17th instant, informing them "that the pictures which are about to be temporarily deposited at South Kensington, being totally distinct from the Collection of the South Kensington Museum, will necessarily continue subject to the arrangements which have hitherto been invariably observed at the National Gallery."

The Council conclude from this communication that the Trustees of the National Gallery do not propose that the Vernon and Turner collections, when located with the Sheepshanks collection, shall be opened to the public in the evening, in common with that interesting gallery and the other portions of the South Kensington Museum; and, further, from the terms of your letter, that the power to concede what this Society asks does not rest wholly with the Trustees.

The paintings which form the Vernon and Turner collections were free gifts made some years since to the public, who, up to this time, have had no means of fairly seeing them and appreciating their great value. The Sheepshanks collection was a later gift, of the same generous nature, but the prudent foresight of the donor connected it with one of the most popularly managed and accessible public institutions of the day, and it was immediately made available for the full enjoyment and instruction of the public. Convenience, by a happy chance, will shortly bring together these three collections of the best works of British artists (whether temporarily or not the public will determine). Galleries to contain them have been erected at the public expense, planned to form in every respect one commodious, continuous, and unobstructed suite, and they will constitute one great collection, and the nucleus of a still greater, truly national one, which no accidents as to management should separate, and which the convenience of the public requires should be as much one in all its external arrangement as it undoubtedly is in its own intrinsic character.

So far as the Council can judge from the construction of the Galleries, the Vernon, Turner, and Sheepshanks pictures will be opened to the public during the day to every outward sense as one collection, and visitors will freely pass, without the slightest apparent line of demarcation, from one portion to the other. But in the evening, while the Sheepshanks pictures, brilliantly lighted, will continue open to the numbers who can at that time alone derive happy and harmless instruction from them, the other two portions of this united national collection are to be shut off in darkness against the public to whom they belong, and at the very hour at which experience has shown that they may be most usefully enjoyed.

Of this the public will naturally and justly complain, and they will neither understand nor accept the reasons assigned for their exclusion. They will deem the Vernon and Turner pictures a part of the collection with which, for any purpose of exhibition, these valuable works are connected, and they will assuredly reject the notion, so opposed to their interests, that these pictures are a part of a less popularly managed collection located elsewhere, with which they have never been associated.

These considerations have induced the Council, as the representatives of the members of the Society of Arts, and of the numerous Societies in Union with it, as well as on the part of the public, to address the Trustees in reply to the communication received from them. But as the Council have some doubt as to the authority with whom the final decision may rest, they have forwarded a copy of this letter to the Marquis of Salisbury, the minister charged with the superintendence of the collections at South Kensington, and the Council will be promptly prepared, should the sanction of Parliament be necessary, to petition the House of Commons that the whole collection of pictures may be thrown open as freely as the portion given by Mr. Sheepshanks.

The Council desire me to add their entire assurance of the good feeling of the Trustees, and of their wish that the public should have every advantage from these collections, which, formed exclusively of the works of their own countrymen, address themselves to subjects and feelings best understood, and excite emotions best calculated to improve and elevate the mind.

I am, &c.,
P. LE NEVE FOSTER, Secretary.

R. N. Wornum, Esq.,
Secretary to the Trustees of the National Gallery,
Trafalgar-square, S.W.

The following is the reply of the Trustees :—

National Gallery, 31st May, 1859.

Sir,—I beg to acknowledge the receipt of your letter of yesterday's date, which I will lay before the Trustees at their next meeting. In the meanwhile, with regard to the observations therein contained, that "the Council have some doubt as to the authority with whom the final decision may rest," I enclose, for the information and satisfaction of the Council, a copy of the Act of the 19th and 20th Victoria, chap. 29, relating to the National Gallery.

I am, Sir,
Your very obedient servant,
(Signed) R. N. WORNUM,
Keeper and Secretary.

P. Le Neve Foster, Esq., Sec. Society of Arts.

The return recently moved for in the House of Lords by Lord Shaftesbury, which includes all the communications that had been addressed to the Trustees up to the 16th June, has now been printed. From this it appears that letters had been received up to that date from the following Institutions, the managers of which appear cordially to concur with the views of the Council of the Society of Arts in reference to this subject :—

Dover Museum and Philosophical Institution.
St. Mary (Islington) Working Men's Institute.
Darlington Mechanics' Institution.
Derby Working Men's Association.
New Swindon Mechanics' Institution.
British Horological Institute, Clerkenwell.
Windsor and Eton Literary, Scientific, and Mechanics' Institution.
*Yorkshire Union of Mechanics' Institutions.

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* For the first letter, see present vol. of *Journal*, p. 333.

* See *Journal*, p. 532.

Ebbw Vale Literary and Scientific Institution.
Derby Mechanics' Institution.
*Young Men's Christian Association, Aldersgate-street.
Bolton Mechanics' Institution.
Wrexham Literary Institution.
Bradford Chamber of Commerce.
York Institute of Popular Science and Literature.
London Domestic Mission Reading Room, Cripplegate.
London and South Western Literary and Scientific Institution.
Middlesboro-on-Tees, Mechanics Institute.

ON THE APPLICATIONS OF WATER-GLASS IN THE ARTS.

BY F. KUHLMANN, PROFESSOR OF CHEMISTRY AT LILLE.

(*Translated from the French by desire of and communicated by H.R.H. the Prince Consort, President of the Society of Arts.*)

The investigations of Prof. Kuhlmann on the applications of the soluble alkaline silicates in the Arts, are contained in a series of papers read before the French Academy of Sciences in the years 1841 to 1857. They have been collectively published in a pamphlet, the title of which is, "*Silicatisation, ou application des silicates alcalins solubles au durcissement des pierres poreuses, &c., par M. Fréd. Kuhlmann. 3me édition. Paris* (*Victor Masson*), 1858, 8*vo*." To this pamphlet the Report of a French Government Commission on the subject has been appended, which contains so clear and succinct an account of the principal features of Professor Kuhlmann's papers, that it has been selected for translation to draw public attention in England to these researches, which will prove of the greatest utility in many branches of the useful art.

This translation is followed by that of the practical instructions written by Mr. Kuhlmann, in 1857, for the guidance of those who wish to employ his processes, especially the one for hardening porous stone.

REPORT OF THE COMMISSION CHARGED BY THE MINISTER OF AGRICULTURE, COMMERCE, AND PUBLIC WORKS WITH THE EXAMINATION OF THE PROCESS OF SILICIFICATION OF FR. KUHLMANN, PROFESSOR OF CHEMISTRY AT LILLE.

MONSIEUR LE MINISTRE,—The Commission which you have charged by decree of October 29, 1857, to report on the results obtained by Mr. Kuhlmann, Professor of Chemistry at Lille, on the employment of soluble alkaline silicates for hardening porous stones, for painting, &c., has communicated with the inventor of this ingenious process. Mr. Kuhlmann has most readily given every assistance to your Commission. He has explained to us the theoretical principles which have gradually led him to the creation of a new industry; he has opened to us his laboratory, in which the Commission has found the realisation of all the practical facts announced by the inventor, and been enabled to follow, as it were, step by step the progress of his idea; he has likewise thrown open to our inspection his chemical works of la Madeleine and of Saint-André, near Lille, in which the manufacture of soluble alkaline silicates and of sulphate of baryta has been already carried on to a considerable extent, and is increasing from day to day; and he has shown us the various monuments and houses at Lille to which the process of silicification has been applied.

The facts which were pointed out to your Commission, and the experiments which were performed before us, are of the highest importance to science, the arts, and industry. Geological theories of the highest order with regard to the formation of rocks, the possibility of reproducing artificially and by very simple means most of the crystalline mineral matters, the transformations which have been accomplished in the organs of plants and animals the petrified remains of which we find in the bosom of the earth, stand, according to Mr. Kuhlmann's exposition, in an intimate and happy connexion with the more practical considerations concerning the formation of new cements, the hardening of porous limestones used for preserving monuments, the application and the fixation by means of alkaline silicates of mineral colours upon stone, wood, glass, metals, paper, stuffs, &c., and the substitution of a new white colour (the sulphate of baryta) for white lead and zinc white. We scarcely know what ought to be most admired in Mr. Kuhlmann,—his ingenious and scrutinising mind, or his perseverance and tenacity in pursuing the realisation of his ideas, and in rendering his methods more general, for which purpose he has not hesitated to incur considerable expense.

Theory of Hydraulic Cements.—The silicious solution, silicate of potash or silicate of soda, forms the basis of all the new processes. Since 1840, researches upon the origin and nature of the efflorescences upon walls have furnished Mr. Kuhlmann with the opportunity of ascertaining the presence of potash and soda in most of the limestones of the various geological epochs, in larger proportion in hydraulic limestones than in fat limestones (*à chaux grasse*). What would be their influence upon the hydraulic properties of the lime? Mr. Kuhlmann thought that, under the influence of potash or soda, silicious limestones might give origin, when calcined, to double compounds of lime, silica, or alumina and an alkali analogous to those which would be obtained by the calcination of some kinds of hydrated minerals, such as apophyllite, stilbite, and analcime, and that these compounds, when afterwards brought into contact with water, would undergo an action analogous to that which causes the consolidation of plaster, viz., hydratation and at last perfect hardness.

The principal effect of the potash and soda would consist in transferring a certain quantity of silica to the lime, and in giving origin to silicates which absorb water with avidity (so as to leave only that portion of water necessary to their hydrated nature) and become solidified. Numerous facts bore out this theory. Quicklime, when left in contact with a solution of silicate of potash, is immediately transformed into hydraulic lime. Quicklime and an alkaline silicate, very finely pulverised, and mixed in the proportion of 11 of silicate to 100 of lime, likewise furnish an excellent hydraulic lime. A mortar of fat lime repeatedly wetted with a solution of alkaline silicate is transformed into hydraulic mortar. Lastly, with the glassy silicate and lime, more or less energetic hydraulic cements can be produced at will, which will be found very useful in countries where only fat limestones exist.

Silicification.—From observing the great affinity of lime for silica when set free in a nascent state from its compound with potash, Mr. Kuhlmann was led to study the action of the silicates of potash and soda upon the calcareous stones —upon chalk in particular. He observed that by placing some chalk in contact with a solution of silicate of potash in the cold, a portion of the chalk is transformed into silico-carbonate of lime, whilst a corresponding portion of potash is displaced, that the chalk hardens gradually in the air and acquires a greater hardness than that of the best hydraulic cements; if the chalk is made into a paste with the silicate, it will adhere strongly to bodies, to the surface of which it is applied. Thus a cement was discovered, capable of being employed in restoring public monuments and in the manufacture of cornice-work. Pushing his experiments further, he ascertained that chalk, when plunged into a solution of silicate of potash, was capable of absorbing a considerable quantity of silica; by exposing it alternately and repeatedly to the action of the silicious solution and to that of the air, he found that this stone acquired in time a great hardness on the surface, and that the hardening, which was at first superficial, penetrated gradually to the centre, so that a piece which had been subjected to the process fifteen years ago, and which was examined by your Commission, had become hardened to a depth of nearly a centimetre. This silicification of the stone (this is the name given by Mr. Kuhlmann to this transformation) is due to the decomposition of the silicate of potash by the carbonate of lime on the one hand, and by the carbonic acid of the air on the other. A solution of silicate of potash when left to the air gives origin, in fact, after some time, to a gelatinous and contractible deposit of silica and to a stratum of carbonate of potash. In course of time the deposit of silica acquires sufficient hardness to scratch glass. Two balls of chalk of the same diameter and of the same nature were silicified under the same conditions: the one was exposed to the free action of the air, and acquired more hardness than the second, which was kept under a bell-glass in an atmosphere deprived of carbonic acid. In silicification, therefore, as long as the stone is porous enough to continue absorbing silicate of potash, a sort of hydrated silico-carbonate of lime is formed, which hardens by gradually losing its water of hydratation, besides a contractible layer of silica which adds to the hardness of the stone. The carbonate of potash produces on the surface an almost imperceptible exudation, which diminishes gradually and at last disappears entirely without having in the least altered the surface of the stone; by means of hydro-fluosilicic acid Mr. Kuhlmann has succeeded in getting rid of the inconvenience which might result from this, and even in adding to the hardness of the stone. Calcareous stones thus prepared acquire a compact grain, and a lustrous appearance, and become capable of receiving a fine polish. The hardening is singularly assisted by heat; the calcareous porous stones, on being plunged into a high-pressure boiler containing a bath of silicate of potash, presented, as soon as they were withdrawn from this immersion, all the characters of compact silicious limestones without the least intervention of the carbonic acid of the air.

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* See *Journal*, p. 521.

From limestones Mr. Kuhlmann passed on to porous stones, and has succeeded in showing that the action of the carbonic acid of the air upon silicate of potash was sufficient to effect a superficial consolidation of the stones, varying with their porosity.

Upon sulphate of lime or plaster of Paris the action of silicate of potash is essentially the same; but it is more rapid, and has the disadvantage of giving rise to the formation of sulphate of potash, which, on crystallizing, disaggregates the surfaces. Consequently the silicious solution ought to be more diluted, so as to render the action slower; the consolidation, however, must be sufficient to avoid the effects of the crystallization of sulphate of potash.

Mode of Application.—In what way does Mr. Kuhlmann apply the silicate of potash upon monuments and buildings in general? He takes silicate of potash prepared in his works and possessing the composition of soluble glass, and dissolves it in twice its own weight of water. This solution is to be had in commerce, and marks 35° of Beaumé's areometer. All that is required is to dilute this with twice its volume of water, in order to obtain the degree of concentration most convenient for the process of hardening. In recent buildings it may be applied at once; older constructions require to be cleansed by washing with a hard brush or by means of a solution of caustic potash, and most frequently by smart scraping. Large surfaces are sprinkled with the silicious solution by means of pumps or large syringes with divided jets. The latter have been employed in Germany since 1847. Care must be taken to collect the excess of liquid by means of gutters of glazed earthenware placed at the foot of the walls. For sculptures and certain portions of buildings, soft brushes are employed, and, with great advantage, also the painting-brush. Experience has shown that three applications of silicate, on three consecutive days, suffice to harden stone. The quantity of solution which is absorbed varies with the nature of the stone and its porosity; the cost of silicate does not exceed 75 centimes (7½d.) per square metre for the most porous stones.

This process has been applied to the new sculptures of the Exchange at Lille, to the works of restoration in the Church of St. Maurice, to the construction of a new church at Wazemmes, to the hospital of Seclin, to some works of the Corps du Génie, and to several private buildings at Lille; it has been found to answer perfectly.

Since the year 1841, Messrs. Benvignat, Marteau and Vorly have tested the efficacy of the new process. It has likewise been employed in other places, at Versailles, at Fontainebleau, at the Cathedral of Chartres, at the Town Hall of Lyons, at the Louvre, and at the Cathedral of Notre Dame in Paris. The best architects, such as MM. Lassus, Lefuel, Violet-le Duc, etc., having obtained most satisfactory results.

Dyeing of Stones.—Mr. Kuhlmann observing that the silicification of buildings and sculptures gave rise to various colorations which rendered, for instance, the joints more marked, was led to seek a remedy for these colourations. By means of a double silicate of manganese and potash, he obtained a dark solution which could be applied to very white limestones. By suspending some artificial sulphate of baryta in the silicious solution, he was able to introduce a little of this sulphate into the porous stone together with the silica, in such a manner as to whiten surfaces of too dark a hue. He proved experimentally that porous limestones, when boiled in solutions of metallic sulphates (the oxides of which are insoluble in water), give rise to the fixation, to a certain depth, of these oxides in intimate combination with the sulphate of lime. With sulphate of iron he obtained a rust-colour of more or less intensity, with sulphate of copper a magnificent green tint, with sulphate of manganese brown tints, with a mixture of sulphate of iron and sulphate of copper a chocolate tint, etc. He observed at the same time, that the double sulphates thus formed penetrated into the stones, and likewise increased their hardness.

Silicious Painting.—There was but one step from silicification to silicious painting. Fuchs, Professor of Mineralogy at the University of Munich, had already, in 1847, given the famous German painter, Kaulbach, all the advice necessary to enable him, by means of a sprinkling with silicate of soda, to fix the fresco-paintings which were then executed in the New Museum at Berlin. Mr. Kuhlmann went further, and applied the colours directly by means of a brush. He had observed that the action exerted by carbonate of lime upon the silicates of potash and soda, viz., the displacement of silica, was likewise exerted by the carbonates of baryta, strontia, magnesia, iron, lead, &c., and even by other salts, such as chromate of lead, most of the metallic carbonates, and even the oxides of lead and oxide of zinc.

He endeavoured at first to replace, in the application of mineral colours upon stone, the fixed and essential oils usually employed by solutions of silicate of potash. With white lead, the formation of silicate of lead was too rapid to permit the application of this colour by means of the painting-brush. Oxide of zinc gave satisfactory results. The artificial sulphate of baryta, which had already found employment in whitening stones of too dark a colour, was again usefully employed; and by mixing it in large proportion with the oxide of zinc, Mr. Kuhlmann obtained a white colour of greater brilliancy and transparency. It appeared at first that sulphate of baryta could not be employed by itself; but it was found that by applying it repeatedly by means of glue or starch paste, or by means of a mixture of starch paste and silicious solution, it covered as well as white of lead and zinc-white in painting with size or paste-colours. This observation was of the highest importance; a new white colour was found which could be employed in the place of those hitherto in use.

New White Colour (base blanche).—Your Commission has been vividly impressed with the results already obtained by the employment of artificial sulphate of baryta in the decoration of several buildings at Lille. The brilliancy and whiteness of the finest white lead is but dim when compared with painting in sulphate of baryta. This colour possesses the advantage of remaining unaltered under the influence of emanations of sulphuretted hydrogen; it enables us to execute dim or lustrous white paintings at a saving of about two-thirds. Its use must likewise appear of immense service, viewed from a sanitary point of view. It gets rid, on the one hand, of the dangers attending the manufacture and application of white lead and oxide of zinc, on the other, of the odour of the essential oils. Mr. Kuhlmann has not shrunk from establishing the manufacture of this baryta-white upon a large scale. In his works at Loos (Nord), the native sulphate of baryta or heavy spar is transformed into chloride of barium, which, when treated in its turn with sulphuric acid, at the works of St André (Nord), is again converted into sulphate of baryta, which is thus obtained in a state of extreme division and purity. This manufacture is already capable of supplying to the trade about 600 tons per annum of the new colour, which find an easy sale.

This new branch of useful industry does great honour to Mr. Kuhlmann; and your Commission would point it out to you as an important progress. For the sake of economy and sanitary amelioration, it would be desirable to see it employed in military buildings, in barracks, schools, public monuments, and in the most humble dwellings.

Mineral Colours (Bases colorées).—Mr. Kuhlmann, passing from whites to the various coloured mineral substances, has observed that under the influence of silicate of potash or soda, the same reactions are produced; that colours which are alterable by the alkalies cannot be employed, but that the ochres may be used, as well as blue and green ultramarine, oxide of chromium, zinc-yellow, sulphide of cadmium, red lead, calcined lamp-black, oxide of manganese, &c.; that the colours which dry slowly may be rendered fit for painting by mixing them with colours which dry more readily, or by the addition of white colours which dry rapidly. He found, moreover, that colours which were ground with a concentrated solution of an alkaline silicate may be applied more readily upon silicified stones than upon those which have not been silicified; that in this latter case it is always useful to impregnate the surfaces, some little time before applying the colours, with a weak solution of silicate; that in painting apartments, the ordinary process of painting in distemper will be found sufficient; and then, to fix the colours, two coats of silicate of potash or soda, marking 6° to 10° of the areometer of Beaumé, are to be applied by means of large and soft brushes, at an interval of several hours.

Upon Wood.—Upon wood, the application of silicious painting presented some difficulties. Woods impregnated with resin do not receive the colour uniformly. Wetting with the water of the solution tends to cause the wood to crack. Ash and yoke-elm, however, answer very well with a few precautions. Mr. Kuhlmann has been able to submit to your Commission some rather old paintings upon wood which had resisted numerous washings, and the intense heat of a fire, close to which they were placed.

Upon Glass.—Your Commission has examined with the greatest interest paintings which have been executed upon glass. Artificial sulphate of baryta, applied to glass by means of silicate of potash, imparts to it a milk-white colour of great beauty; in a few days the silica is found intimately combined with it, and the colour resists washing with warm water. By the action of a strong heat, this silicious varnish is transformed into a fine white enamel. Blue ultramarine, oxide of chromium, and pulverised coloured enamels may be applied. Silicious painting upon glass is destined to find advantageous employment in the construction of church windows, whilst silicious painting upon stone will serve for mural decorations.

Following the same order of ideas, Mr. Kuhlmann has extended his researches to printing upon paper and upon stuffs, to the employment of silicate of soda in scene-painting and in dressing stuffs.

Upon Paper.—By grinding the finely-divided charcoal which is employed in the manufacture of Indian ink with the silicate, a writing ink is obtained which is almost unassailable by any chemical agent.

Upon Stuffs.—In calico-printing, silicate of potash replaces albumen, which is now employed for fixing colours. The silicious solution is mixed with the colours at the moment of printing; in a few days the design acquires such a consistency that the colours resist washing and soap, provided they are not alterable by alkalies.

Printing and Dressing Stuffs.—From a series of experiments undertaken with the view of showing that in dyeing it is not correct to assume that nitrogenous substances possess a greater aptitude for receiving colours than non-nitrogenous substances, and that dyeing rests essentially upon a chemical combination with the textile material, either in the natural state or variously combined or modified, Mr. Kuhlmann was induced to replace the albumen used in printing stuffs, either by a compound of gelatine and tannin, or by starch paste fixed upon the cloth by means of lime or baryta water, or also by the soluble silicates. In printing upon paper, he has succeeded in replacing the varnish with which it is usual to cover the colours which have been fixed by means of gelatine, by a layer of tannin, and even the gelatine itself by starch fixed by means of lime or baryta.

In the dressing of stuffs he has succeeded in introducing the use of tannate of gelatine (by means of which he obtains a permanent dressing), and that of soluble silicates.

Tannate of gelatine constitutes a sort of artificial leather, with which he covers, instead of varnish, wood, paper, chalk drawings, casts in plaster of Paris, sail-cloths, ropes for naval use, &c.

Lastly, by introducing in painting in distemper the processes discovered for fixing colours upon paper and stuffs, he has created the method of painting with tannate of gelatine, or with starch fixed by lime or baryta, or mixed with a silicious solution.

These researches constitute an extremely remarkable and striking whole. Each portion of Mr. Kuhlmann's house exhibits a specimen of one of the processes which he has pointed out; and the examination of these has convinced your Commission that most of these processes are destined to find practical application in arts and manufacture, in spite of the obstacles of routine.

Your Commission, sir, has thought it right to present you with a complete abstract of all these works, in order to show you that we have conscientiously endeavoured to accomplish the mission which you entrusted to us, and to convince you of the great merit of these several researches and discoveries.

Distribution of Pamphlets.—Your Commission feel convinced that Mr. Kuhlmann's labours are of great interest to the engineer, and has no hesitation in declaring itself in favour of distributing the pamphlets in which these processes are described among engineers, builders, and manufacturers.

Builders and engineers may any day be called upon to take advantage of the methods of hardening stones, and of silicious painting in a great number of buildings. Is it not highly desirable that their attention should be directed to these new methods, which may even receive useful modifications from their hands? May they not thus familiarise the public with these processes? Most of them, and some mining engineers, are engaged in some important researches on cements and hydraulic mortars. May they not find, in the scientific considerations presented by Mr. Kuhlmann, the germ of improvements to be introduced into the methods which they daily employ?

The distribution of pamphlets to mining officers, appears at first sight of less importance. Mr. Kuhlmann has, however, been able to introduce into his experiments scientific considerations with regard to the formation of rocks, and especially of crystallised minerals, which are very important for the history of our globe.

Geological Considerations. — On reflecting, says the author, upon the admirable reaction which causes the hardening of limestones by silica, are we not naturally led to attribute not only all infiltrations and crystallisations of silica in calcareous rocks, but also the formation of an infinity of natural silicious and aluminous pastes to analogous reactions? Are we not induced to admit that the flint-stones, the agates, petrified woods and other silicious infiltrations have had no other origin, but that they owe their formation to a slow decomposition of alkaline silicate by carbonic acid?

By simple exposure to the air, and by a slow contraction, Mr. Kuhlmann has succeeded in obtaining masses of silica hard enough to scratch glass, translucid aluminous pastes, hydrated oxyde of tin with vitreous aspect, &c. The numerous experiments undertaken by him upon this subject, and described in his pamphlets, are of the greatest interest. Several mining engineers have already undertaken analogous experiments, and Messrs. Ebelmen and De Sénarmont have obtained very remarkable results. The experiments of Mr. Kuhlmann may put these engineers who devote themselves to these studies in the way of more complete results.

In two memoirs presented to the Academy on the 9th and 16th of November, 1857, Mr. Kuhlmann throws fresh light upon the mode of explaining the silicious infiltrations and the calcareous concretions in shells,—for instance, upon the possible formation of various epigenies, upon the gradual hardening of recently extracted stones, by the slow loss of what is usually called quarry water, and lastly, upon the spontaneous crystallization of amorphous matters, in consequence of an extremely slow contraction, in which time, and also heat and pressure, constitute principal elements.

Mr. Kuhlmann, taking up some researches commenced by Fuchs, has just added fresh and important facts to his applications of the alkaline silicates in painting, in the preparation of artificial hydraulic limes, and in the silicification of calcareous stones. These results are not yet published, but have been communicated to your Commission and may be summed up as follows:—

The oxides and metallic salts which enter into the composition of silicious colours or of cements, have the property not only of combining with the silica of the silicates, but also of fixing, in an insoluble state, variable quantities of potash. The colours which act most energetically in this respect are the ochres; oxide of manganese, oxide of zinc, oxide of lead, and artificial sulphate of baryta also retain potash.

These observations, brought to bear upon the existence of potash in a large number of natural silicates, have led Mr. Kuhlmann to prepare artificially, by the humid way, various compounds of that nature,—felspars, alkaline silicates, magnesian silicates, &c. On applying them to the theory of hydraulic limes, they confirm the special character which Mr. Kuhlmann attributed to them at the commencement of his investigations.

He hopes he will be able to show that excellent cements may be obtained without the intervention of carbonic acid, merely by the slow consolidation of the silicates of lime, of alumina, or of magnesia and potash, and that the natural hydraulic limes approach more or less, in their composition and their properties, to the nature of these cements.

Lastly, Mr. Kuhlmann has obtained excellent results in the fixation of potash in the silicification of soft limestones, by substituting aluminate of potash for the hydro-fluosilicic acid, the employment of which he had advocated with a view of forming in the stone a compound analogous to mica. He thus replaces mica by felspar, which likewise fixes potash in a state of insolubility. From this, he also concludes that in calcareous stones the presence of alumina alone may explain the fixation of a certain proportion of potash, and ought to remove every fear of any alteration in silicified limestones by the slow action of time.

Geological science cannot but gain by making these results known to all those engaged in mining works; and your Commission would, therefore, strongly advocate the distribution of the pamphlets referred to amongst these, as well as amongst builders and engineers.

Conclusion.—Your Commission, actuated by a strong desire of making known and appreciated, as much as lies in its power, the important researches of Mr. Kuhlmann upon silicification, would propose in conclusion—

1. To have distributed to the services of Ponts et Chaussées and of mining, the pamphlets in which the results of Mr. Kuhlmann's works on silicification are to be found, and to call the special attention of engineers to the advantages which they may derive from the new processes.
2. To order the publication of the present report in the "Annales des Ponts et Chaussées," and in the "Annales des Mines."

Lille, Feb. 8th, 1858.

(Signed)
BOURDOUSQUIE, *Ingénieur en chef des Mines*, President.
KOLB, *Ingénieur en chef des Ponts et Chaussées.*
BOSSEY, *Ingénieur ordinaire des Mines*, Reporter.

Practical Instructions on the use of Soluble Alkaline Silicates (Water-Glass) in Painting, and for Hardening Stones.

By Fr. Kuhlmann, Professor of Chemistry at Lille.

The application of the soluble silicates in hardening stones and in painting has now been sanctioned by experience to such an extent*, that it may be considered as one of the most useful conquests which the art of building has made for many years past. This is the unanimous judgment of the most competent men of science, as expressed in learned societies, at scientific meetings, and by the International Jury of the Great Exhibition of 1855 at Paris.

I thought that little good would be done to the art of building, by merely pointing out to the public the results of new observations, or by directing attention towards the causes of the observed phenomena, and referring to their scientific, industrial, and artistic applications, but that builders and painters ought also to be specially initiated into all the details of the many useful applications of the new chemical product, which is as yet but little met with in commerce, and the employment of which is in itself an innovation in architecture and monumental painting. I have endeavoured to produce these silicates economically, and on a large scale, and to render their application practicable. By enabling builders and painters to profit by my own experience, I hope to spare them the trouble of numerous trials, which, from clumsiness or ignorance, often lead to failures, and thereby delay the general application of an invention.

Although I was determined from the beginning of my researches not to make my investigation of the soluble silicates the object of a mere French interest, I have nevertheless thought it desirable to ensure for myself the right of priority, in order to be able to repel any attempt which might be made to usurp my rights, and to give up the fruits of my researches to the public after possessing the guarantee of having them protected by letters patent, which never fail of effectually aiding a new discovery which is of interest to manufactures and the arts.

I have established works for the manufacture of the soluble silicates, or water-glass, in the Department du Nord; and the process adopted is so simple and economical, that, in spite of the present high price of the alkalies, these silicates can be delivered by the house of Kuhlmann and Co., at Lille, at the following prices:—

100 kilogrammes (200 lbs.) of silicate of potash, in solution, marking 35° Beaumé, at	35 francs.
100 kilogrammes of solid silicate of potash at. .	90 francs.
100 kilogrammes of silicate of soda, in solution, marking 35° B.	30 francs.
100 kilogrammes of silicate of soda, in solution, marking 50° B.	40 francs.
100 kilogrammes of solid silicate of soda	70 francs.

These products are also to be had at the Central Dépôt in Paris, from M. J. Drouin, Rue Ste. Croix de la Bretonnerie, No. 21, at 5 francs more per 100 kilogrammes.

1. Hardening of Stones.

Silicate of potash is advantageously employed for hardening porous stones, as well as for consolidating soft sandstones or bricks. Silicate of soda, although producing the same effect with regard to hardening stones, gives rise, after some time, to unsightly efflorescences.

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* A considerable number of public buildings have been successfully treated with water-glass, amongst which are the Louvre and Notre-Dame at Paris, the Cathedral of Chartres, the Napoleon Barracks, the Exchange at Lille, and various churches and buildings in the Department du Nord.

Preparation of the silicious solution.—A solution of silicate of 35° strength, such as may be had in commerce, contains a third of its own weight of solid or vitreous silicate. It has been made of such a strength, as to render it necessary to dilute it with twice its own volume of water, in order to obtain a liquid of the proper concentration for hardening stones. Builders who are little acquainted with chemical manipulations are thus enabled, by means of these simple indications, to employ either the solid or the liquid silicate. The silicate of 35° ought to be diluted with twice its volume of water; and the solid silicate requires to be dissolved in six times its own weight of water. The solution of the solid silicate is not quite without difficulties; it is more easily effected in water which has already been charged with a little silicate, than in pure water. This is heated to ebullition in an iron boiler, and the silicate added in the state of powder, or in small pieces.

These proportions need not, however, be rigorously adhered to. A silicious solution of a slightly different degree of concentration may still give good results. I would, however, remark that too weak solutions require frequent repetition of the process of impregnation, whilst too concentrated solutions are ill-suited for a thorough penetration, and consequently for a proper hardening of the stone.

Mode of action of the solution.—The silicious solution, when brought into contact with porous stones in the manner to be explained hereafter, is absorbed by them. After exposing them for some time to the air, they will be able to absorb a fresh portion of solution, and in a similar manner a third and a fourth; but the quantity of liquid thus absorbed diminishes with every new operation, and at last absorption ceases altogether, when the pores of the stone are completely filled with the silicious matter.

The quantity of solution which may be thus absorbed varies with the nature of the stone, the coarseness of its grain, and its porosity. It is calculated, however, that a calcareous stone of average porosity can be effectually treated with silicate at 3½d. per square yard.

The hardness of the stone will depend as well on the quantity of silicate absorbed, as on the quality of the silicate which has been employed; so that if the work is done by contract, the proprietor may be liable to serious miscalculations.

Method of applying the silicious solution.—This varies with the nature of the buildings which have to be treated. In more recent constructions it may be applied at once; but in older buildings the stones require to be cleansed, in order to facilitate the absorption of the silicious solution. Mere washing rarely suffices; and scraping will always be found preferable whenever it is applicable, or else washing and scrubbing with a hard brush, or with a solution of caustic potash; acidulated water must on no account be used.

If the stone be of small extent, such as a statuette, or a piece of ornament, the silicious solution is applied by simple immersion for some hours, which ought to be repeated several times.

Large surfaces are coated with the silicate by means of fire-engines, or large syringes with broad rose-nozzles, taking care to collect at the foot of the walls, by means of gutters made of burned clay, of plaster, or of cement, the excess of the liquid, which may again serve for fresh operations till it is entirely exhausted. When the silicification is only applied to certain portions of a building, *e.g.* upon sculptures, a soft brush may be employed, which acts like a sponge, retaining a quantity of liquid, so as to furnish to the surfaces which have to be silicified as much of the solution as by way of sprinkling or immersion.

In all cases the window-glasses have to be protected by means of cloths against the action of the silicious solution, which would leave spots which cannot be removed when once dry.

Between two successive applications of the silicious solution, an interval of several hours ought to be allowed, or, better still, an interval of a day. Three applications on three consecutive days will generally be found sufficient for hardening the stone thoroughly. If the operation be repeated too often, the stone will be found coated over with a vitreous coat of a shining disagreeable aspect, which would necessitate repeated washings with water immediately after the last besprinkling. There are, however, stones so porous that this inconvenience will hardly show itself.

The application of the silicate may be effected all the year round, except in days of hard frost. Dull weather is preferable to warm and dry weather. When the sun is shining warm, it is advisable to protect the work by means of cloths, in order to avoid too rapid desiccation.

II.—Silicious Painting and Printing.

I have substituted the application of the silicious colours by means of the painting brush for the German process, which consists in treating paintings in water-colours with the silicious solution by means of a syringe with a rose-nozzle—a process which often gives rise to unequal fixing, and which is of difficult and uncertain execution.

The application of the colours, however, is done in various ways and conditions. In painting upon stone, upon a wall, or upon glass, &c., the colours, after having been ground with water and kept in a pasty state, are immediately mixed with a silicious solution of 15 to 20 degrees, and applied exactly as in oil-painting and distemper painting, except when a very porous stone is employed, which had better be slightly silicified before applying the colours, to prevent a too rapid desiccation by the porous body; for glass and earthenware, the silicious solution ought to be more concentrated.

Painting upon wood is equally efficient, provided the wood be not impregnated with resin, which repels the colour, as would also be the case if one were to apply silicious painting over old oil-paint.

Colours acted upon by the alkalies cannot be advantageously employed for this kind of painting. Those which answer best are the ochres, blue and green ultramarine, oxide of chromium, zinc-yellow, sulphide of cadmium, red lead, calcined lamp-black, oxyde of manganese, zinc-white, artificial sulphate of baryta, &c.

Independently of this method of painting, I have with great success applied a kind of mixed style of painting to rooms, where the silicates merely serve as a means of fixing the colours, which may afterwards be washed with water. The painting is done in the usual manner in distemper, and, in order to fix the colours, two layers of silicate of potash or of soda are applied by means of the painting brush; the first layer with a solution of 6° of Beaumé's Areometer, and the second of about 10° strength, allowing an interval of some hours at least between each application of the silicious solution.

This method of fixing distemper-painting might be employed in the manufacture of coloured papers. For this purpose (as also in painting) I have substituted fecula or starch for the ordinary size, with great advantage. But as starch gives a somewhat granular paste with colours, I add to it some dextrine or soluble starch in various proportions, according to the fineness of the work to be executed.

In all these kinds of distemper-painting I employ with the greatest success as a white colour the artificial sulphate of baryta, the manufacture of which I have established on a large scale in my chemical works. This sulphate covers perfectly well when silicious colours or distemper colours are employed; it is of a perfect whiteness, entirely unalterable by sulphurous emanations, such as sulphuretted hydrogen; and its price in the state of a solid paste is only 20 frs. the 100 kilos. when ordered directly from Lille.

More information on silicification, and especially on the applications of silicates and of the artificial sulphate of baryta in painting, will be found in a publication entitled

"Applications of Soluble Alkaline Silicates," &c., 1 vol. 8vo. which may be obtained from M. Victor Masson, 17 Place de l'Ecole de Medecine at Paris, and at Lille from M. Danel, Grande Place, 18.

In this pamphlet I have treated likewise of typographic printing, and of printing on stuffs by means of silicates. This last application has been carried out in the most satisfactory manner in the large Calico Printing-works of Messrs. O'Neil and Sons at Manchester. I have also pointed out the useful application of the silicates in the dressing of stuffs or yarn. I have also recommended the use of silicate of soda, especially with a little arsenite of soda, for the preservation of timber from dry-rot and insects. M. Fuchs long since proposed this salt for rendering wood and stuffs less combustible. In Germany, experiments have lately been made with the view of substituting the soluble silicates for crystallized carbonate of soda in cleansing wool. Soap manufacturers have likewise employed the silicates in order to fix a large quantity of water in their products; whether this is to the advantage of the consumer, will scarcely bear inquiry. Lastly, one of their most useful applications consists in the fixation of mordants, which enables us to dispense with cow-dung in the manufacture of printed calicoes.

My various methods of painting have been attentively studied by Messrs. Mottez et Flandrin, historical painters at Paris; by Count de Galembert, historical painter at Tours; by M. Denuelle, decorator and painter at Paris; by M. Leclaire, who has been charged with the silicification of the new buildings of the Louvre, and with the harmonization of the tints of the new and old parts of the building, and who has likewise obtained excellent results with my method of silicious painting. I would also mention Messrs. Vicar and Brebar, painters and decorators, who have executed numerous silicious paintings at Lille.

COMPRESSED FODDER.

An ingenious invention has just been adopted by the French Minister of War for the better feeding of cavalry horses when on the march. M. Naudin, veterinary surgeon of the Imperial Guard, has succeeded in compressing the food for the journey into small tablets like those already in use composed of vegetable food for the army. M. Naudin has given publicity to his process, and it is destined, no doubt, to render immense service to the commissariat departments in every country. The hay and straw are chopped fine, the oats and corn crushed, and then mixed in proportion to the nutritive qualities afforded by each. Upon the mixture is poured a mucilaginous residue of linseed, and the whole is pressed and comes out in a hard cake, only requiring to be dried in the oven. Although invented for the emergencies of war, this method of preserving fodder may be found most valuable in reducing the space occupied by the food of cattle on board ship, in distant encampments, or in the long marches of emigration parties. At any rate the method is a valuable extension of Chollet's invention, and has been eagerly adopted for the provender of the French cavalry of the army of Italy.

INSTITUTION OF CIVIL ENGINEERS.

The Council of the Institution of Civil Engineers have awarded the following Premiums for Papers read during the Session recently concluded:—

1. A Telford Medal, to Michael Scott, M. Inst. C.E., for his Paper "Description of a Breakwater at the Port of Blyth, and of Improvements in Breakwaters, applicable to Harbours of Refuge."

2. A Telford Medal, to Robert Mallet, M. Inst., C.E., for his Paper "On the Co-efficients of Elasticity and of Rupture in Wrought Iron, in relation to the volume of the Metallic Mass, its metallurgic treatment, and the axial direction of its constituent crystals."

3. A Telford Medal, to Henry Bessemer, for his Paper "On the Manufacture of Malleable Iron and Steel."

4. A Telford Medal and the Manby Premium, in Books, to William Joseph Kingsbury, Assoc. Inst. C.E., for his Paper "Description of the Entrance, Entrance Lock, and Jetty Walls of the Victoria (London) Docks; with Remarks on the Form adopted in the construction of the Wrought Iron Gates and Caisson."

5. A Watt Medal, to James Wardrop Jameson, Assoc. Inst. C.E., for his Paper "On the performances of the Screw Steam-ship *Sahel*, fitted with Du Trembley's Combined Vapour Engine, and of the Sister Ship *Oasis*, with Steam Engines worked expansively, and provided with partial surface condensation."

6. A Council Premium of Books to Thomas Sebastian Isaac, for his Paper "On the Successful Working, by Locomotive power, over gradients of 1 in 17, and curves of 300 feet radius, on Inclines in America."

7. A Council Premium of Books to Matthew Bullock Jackson, M. Inst. C.E., for his Paper "Description of the Gravitation Water Works at Melbourne, South Australia."

THE OXFORD RAFFAELLE DRAWINGS.

The University of Oxford, during the repairs of its Public Galleries, has liberally consented to the removal of its original drawings by Raffaelle and others from Oxford to the South Kensington Museum, where they will be exhibited for the next two months. Permission has also been given to the Science and Art Department to take photographs of those drawings required to complete the extensive series of Raffaelle drawings which have been collected by the Department from public galleries, at hom and abroad.

Home Correspondence.

ANONYMOUS COMMUNICATIONS.

Sir,—Since the anonymous writer, "I," in a recent number of the *Journal* appeals to the opinion of the non-professional members of the Society as to the propriety of challenging, under a mask, another writer coming openly and unscreened before the public, or the other members of the Society, I for my part do not hesitate to protest most solemnly against such a principle being upheld by the said *Journal*. Allow me to submit to you a few of my reasons for dissenting from the doctrine of your Edinburgh correspondent.

Mr. Campbell is a professional chemist, engaged both by Government and by private parties in chemical investigations. He, therefore, has a character to sustain, and a most honourable one, too; his liberal and disinterested endeavours to promote the good of the Society are moreover known to all the members of the Society who take a real interest in the progress of science and art. Now, in the matter under discussion, he boldly took up the gauntlet which, by some mistake, was thrown at one of the lecturers who happened to illustrate his paper by introducing therein some statements made in a report by Mr. Campbell on coal and coke, and which were taken up and disputed by several members present at that lecture. Mr. Campbell's reply was not retorted by the parties most interested in so doing, but in steps into the arena, without a banner, a knight from the far North, desirous of breaking a lance with Mr. Campbell, sitting firm in his stirrups, with an open visor. A parley ensues; the unknown knight is invited to show his colours and size of his weapons. "Not I," says he, "for I submit that facts and arguments, and not persons, are the proper subjects of a scientific discussion." Quite true, Mr. "I," and I believe Mr. Campbell himself would be one of the first to coincide with you, and woul d feel disposed to see truth elicited, even against himself;

but he insists upon fair play, and so will all honest bystanders. Now, Sir, suppose the anonymous writer, "I," succeeded in refuting Mr. Campbell, would he not make the best of his victory before his friends, and perhaps before the public, at the expense of his adversary, who, if victorious himself, would have no such opportunity afforded to him. In chivalrous language, which must be appreciated by every man of honour, the combat is not to be undertaken on equal terms. One party is to come to the ground with uncovered breast and head, the other is to appear "*armé de pied en cap*," and with the option to retire from the contest without having shown his face, as common parlance has it.

To resume, I think that the adoption of such a doctrine by the Society would be detrimental to its best interests, since many a member would withhold a contribution to the *Journal*, which might prove valuable to the Society, rather than run the risk of losing time and temper in refuting anonymous writers. And this, Sir, is the light in which I wish you to regard these remarks, since I most readily will confess my own ignorance of the real merits of the case under discussion.—I am, &c.,

A. TOLHAUSEN.

London, July 4th, 1859.

THE ROYAL ACADEMY OF MUSIC.

Sir,—On the evening of May 11th, a paper was read before the Society, by Mr. Chorley, "On the Recognition of Music as an Art." In this paper some observations were made reflecting on the Royal Academy of Music, which, in the subsequent discussion which took place, led to some further disparaging remarks. Although some time has elapsed, if these observations are allowed to pass unnoticed a very erroneous impression will be perpetuated against an Institution which—whatever its faults—has unquestionably done good service towards advancing the Art of Music in this country. This must be my apology for trespassing on your space.

The portion of the paper referring to the Academy, commences at the paragraph, "It is true that we have what is called a Royal Academy of Music; an institution which it would be pleasanter to pass by than to enter. By entering it, some pain must be given to worthy persons, but attention must be called to the capricious basis on which that structure stands, and to the peculiarities of its organisation. These are of such a nature that, during the last twenty years, not one single artist—capable of doing England or the Academy of Music credit before the public—has issued thence; not a single singer capable of saying and singing the songs of Handel, or able to cope with foreigners in foreign singing; not a single instrumental player of any renown; not a solitary composition which has lived beyond the hour when it was transcribed from the exercise book. During twenty years past London has contained materials for such a central college as can exist in no other European capital. The illogical consequence has been that our students of both sexes have been driven abroad, partly because of the superior cheapness of instruction—partly because of its superior quality."

I have quoted the passage at length, to show the nature of the charges brought against the Institution. Unfortunately for Mr. Chorley, the period of twenty years, which was evidently fixed upon to cut off one name connected with the Academy, includes that very name. Miss Dolby did not leave the Academy till December, 1839, and was therefore a student within the period so pompously paraded —a fact that triumphantly refutes the calumny so far.

But I would ask, is this the quibbling way in which any Institution is to be judged of? Take the last twenty years of any educational establishment, and it might be difficult to find a single name prominently before the public. Where, during this very time, are the emanations from the conservatoires of Milan, Naples, or Paris? Mr. Chorley would be puzzled to find, perhaps, one single name; or if he did it would be the exception.

The Institution dates its existence from the year 1823, thirty-six years in all, that is, scarcely more than a generation; during this time it has produced many names of distinction in the musical profession, besides a very large number of qualified teachers. Mr. Chorley's limitation to the last twenty years would imply that during the first sixteen years the Royal Academy of Music has not been deficient in the amount of talent produced. Can the same be said of the conservatoires abroad?—a fact Mr. Chorley should have ascertained before he condemned the English institution.

But the real character of any educational establishment, after all, does not rest upon the chance of turning out great talent. No institution can certainly command that, especially within any given period; but it is the business of such institutions to create competent teachers, and these make their impress upon the country at large, and produce a far greater effect upon the advancement of an art than any erratic genius would do. It is the province of an Academy to turn out teachers, and this the Royal Academy has done—not niggardly, but in profusion. For it is a well-known fact, that since its foundation there has appeared a constant succession of teachers, who, establishing themselves in country towns and rural districts, have contributed most unquestionably to the progress of music. And as regards the metropolis, notwithstanding a widespread prejudice in favour of foreign masters, the students of the Academy have held, and still hold, their position as masters. A better style of teaching has been the consequence of more highly qualified teachers; and one of the causes of enmity against the Academy has been raised from the circumstance that wherever the students have settled themselves, they have almost invariably taken a high position as teachers, to the detriment, often, of many of the old established professors.

But granting that Mr. Chorley's statement is true, that during the last twenty years, no singer, instrumental player, or composer, has emanated from the Academy, it must not be forgotten that in this country all are driven to teach; whatever the talent a musical aspirant may have, he cannot devote himself to the pleasures of musical imagination; he is doomed to the daily drudgery of teaching; and who as a teacher can find time for the gratification of a higher standard of perfection? But is it true that in this period no artists have appeared? I think the answer will be found in the advertising columns of the daily newspapers. A glance at these would show at once that the names of the pupils of the Academy appear taking the principal parts as singers and instrumental players in almost every performance, and many of these may yet achieve a high name for themselves. A reputation is not made at once; it is, as all have felt, a very slow result. I will not speak of composers. They must always, like poets, be few and far between. Have any of the Government supported conservatoires abroad turned out composers during the last twenty years? If so, their rumour is a private one. I am not aware that their names have been wafted to these isles. The illogical conclusion Mr. Chorley deduces from these premises is that English students are driven abroad, "partly because of the superior cheapness of instruction and partly because of its superior quality." As for cheapness under Government support and patronage, this may perhaps be true; but in the only parallel instance, that of the Leipsic Academy, if Mr. Chorley had made inquiry instead of assertion, he would have found that though nominally cheaper, the tuition is so scanty that the students are driven to take private instruction, so that in reality the actual expense is greater than at the English Academy. As to the superior quality of the tuition in the Continental Academies, I simply deny the statement. Mr. Chorley has made the assertion, let him prove it.

As to the assertion made that many of these—the foreign professors—"have no place in our Royal Academy, and that this is to be accounted for by the dearness of life here, and the high fees to be obtained by private tutors."

This is entirely a gratuitous assumption. If they have no place here, it is because they are not wanted. I state distinctly, as a fact becoming daily more known, that the tuition of foreigners in music is certainly not better, if indeed it can be said to come up to that of the professors of this country, especially of those who have received their education at the Academy. And Mr. Chorley knows very little about professional musical tuition if he supposes that the system of deputies and subordinates is such as he has ventured to assume. The use of deputies and subordinates is confined almost wholly to the second branches of study—the principal study being always confided to a professor. And it is in this very employment of subordinates that the students who are advanced are themselves taught to teach, which is in reality one of the most important points of the whole system of professional musical education.

In the discussion that followed the reading of the paper, Mr. Chorley, in answer to a question, gives two names, Miss Dolby and Sterndale Bennett, as dating from twenty to twenty-five years ago. Unfortunately for Mr. Chorley's accuracy, Miss Dolby, as I have stated before, was a student within the twenty years, and Sterndale Bennett within the twenty-five years. The animus shown in fixing these periods is self-evident, but in this case it only recoils on Mr. Chorley himself, for his two "last great" names are without his own pale, and thus a palpable suspicion hangs over every statement emanating from such a source. Mr. Dilke only did justice to the Academy when he stated that "he felt bound to say that in his opinion the Academy had done great good to the musical science of the country at large." Mr. Costa, on the other hand, in answer to Mr. Dilke's observation "that the Academy would be the proper medium of communication with the Government," thought, "with all due respect to the Royal Academy of Music, it was no use to mend an old coat," an observation of great importance, coming from so high an authority. Does Mr. Costa know anything of the Royal Academy? Has he ever even been inside the doors? Has he ever taken the trouble to inquire into the character of the tuition given? This at least he should have done before he cast his insinuations abroad against the institution. A moment's consideration ought to have suggested to Mr. Costa, that of the instrumental performers who form the orchestras over which he presides, the students of the much-belied Royal Academy are not those who hold the lowest places; and of the singers who appear before his baton that those from the Academy are not the least worthy of their place. Mr. Costa holds a high position in this country; the English have not been backward in placing him, a foreigner, in a very prominent situation. In such a case Silence would have been becoming, whatever his opinion might be. As it is he has betrayed himself, for the true reading of Mr. Costa's remarks is a new version of the Pleasures of Imagination, in which he figures as future head of some new English academy, of very rapid and impossible pitch of perfection.

As to Government patronage, it is very questionable whether any institution would thrive under such auspices. With the support comes the interference. Can any art flourish patted by the peddling of placemen. It is not an easy thing to found an Institution. You have an Academy; it has withstood the assaults of poverty, unaided, except by a few helping hands. It has poured forth a body of practical musicians that may vie with the lists of the Continental establishments. It wants but the means, and then I do not hesitate to say it has within its own bosom all the elements that could render an institution an ornament to the country, and the worthy foster-parent of its rising talent.

From these observations it will be evident how little qualified Mr. Chorley is to make any assertion whatever relative to the Academy. In the first place he has shown he knows nothing of the system of education carried out there; secondly, he has proved he knows as little in what professional musical education consists; and lastly, he has hazarded charges without having taken the most ordinary care to arrive at the real state of the case. Such ignorance may be bliss to himself, but when thus publicly paraded it becomes an offence, especially against the whole body of Academicians, who, however, can well afford to let Mr. Chorley revel in that mist from which he blandly surmises he can see so clearly.

I am, &c.,
W. W. CAZALET.

GUM FROM CEDAR.

Sir,—The following is, I believe, the solution of the mystery of the deposit of gum on the marble specimens, when confined in drawers made of cedar, as mentioned by your correspondent, Mr. Wm. Brown.

Cedar, especially Havannah cedar, is a very porous wood, and contains a large portion of a somewhat volatile resinous gum, which in damp weather absorbs a considerable quantity of moisture. If the drawer is then closed and the temperature of the room becomes raised, the evaporation from the wood saturates the air confined in the drawer, and the marble acting as a condenser, causes the gum to deposit itself over the surface, the evaporation going on more or less rapidly according to the difference in the temperature of the drawer and of its contents. I apprehend it is the pungent smell produced by this evaporation which disinclines moths and other insects to take up their abode in cedar wardrobes, whilst the gum is not deposited on the clothes contained therein, they being too warm to act as condensers.

I have found cedar, even that which had been cut 20 years, inapplicable for cases for microscope specimens on glass and instruments, because of this peculiarity, which, however, is common to some other woods and roots—ginger especially, the evaporation from which is very rapid, so as to render it worthless for these purposes.

French-polishing the drawers inside and out would most probably cure them. I am, &c.,
FREDERIC NEWTON.
3, Fleet-street, E.C., July 9th, 1859.

PARLIAMENTARY REPORTS.

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SESSIONAL PRINTED PAPERS.

Delivered on 20, 21, 23 *April*, 2, 4, 5, 7, 11, 16, 19, 21, 25, 26, 28 *May and* 2 *and* 7 *June*, 1859.

Par.
Numb.
241. Postage (Liverpool and Canada)—Return.
246. Brass Ordnance Factory (Woolwich)—Return.
247. Iron Ordnance Factory (Woolwich)—Return.
248. Military and Naval Officers—Return.
258. The Clock (New Palace, Westminster)—Return.
260. Spirits—Returns.
263. Post Office—Returns.
228. Lunacy—Supplement to 12th Report of Commissioners.
165. Superannuations (Public Offices)—Account.
177. Coal Mines—Returns.
220. Court of Probate, &c. (Acquisition of Site) Bill—Evidence.
245. Divine Service (Army)—Return.
253. Smithfield Site—Return.
255. Poor Relief (Ireland)—Return.
256. Pembroke Dockyard Gasworks—Return.
262. Savings Banks (Number of Depositors, &c.)—Accounts.
262 (1). Savings Bank—Return.
264. Coals, Cinders, and Culm, &c.—Account.
266. Licensed Trades—Account.
270. National Debt—Account.
221. Chichester Harbour Embankment—Return.
261. Statue Law Commission—Return.
268. Probate Court—Return.
204. Lunatics—Report from Committee.
115. Grand Jury Presentments (Ireland)—Abstract of Accounts.
232. Army (Desertions and Enlistments)—Return.
250. Small Arms—Returns.
269. Divorce and Matrimonial Causes Court—Returns.
238. East India (Punjab)—Papers relating to the Mutiny.
226. Private Bills—Return.
198. Colonization and Settlement (India)—Report.
68 (4). Trade and Navigation Accounts—(30 April, 1859).
249. Enfield Factory—Return.
257. Galway and Shannon Ports—Return.
216. East India (Artillery)—Return.

265. Excise Duties—Account.
240. Colonies—Return.
194. Ecclesiastical Courts—Return.
195. County Court Commitments—Return.
234. East India (The Nizam, &c.)—Papers.
Post Office—5th Report of the Postmaster General.
Shipowners—Copy of an Address and Correspondence.
Statistical Abstract for the United Kingdom (1844 to 1858).
Indian Army Commission—Report of Major General Hancock.
Austria and Italian States—Treaties (Political and Territorial) 1815 to 1848.
Indian Army—Report of the Commissioners.
Civil Service—4th Report of the Commissioners.
Harbours of Refuge—Report of Commissioners, Vols. 1 and 2.
Public General Acts—Cap. 10 to 35, and Table.

Session 1857—58.

98 (A xiv.) Poor Rates and Pauperism—Return (A).
483. Sessional Printed Papers—Numerical List and Index.
483 (1). Do. do. Titles and Contents.
510. Civil Services—Return.

Delivered on 8th June, 1859.

208. Poor Rates and Pauperism—Return (A).

Delivered on 9th June, 1859.

225. Small Tenements—Return.
Education—Report of the Committee of Council.

Delivered on 10th July, 1859.

259. East India (Railway, &c.)—Papers.

Delivered on 11th July, 1859.

Bill—Jury Trial (Scotland)—Act Amendment.
Italy—Correspondence respecting the Affairs of.

First Session, 1859.

252. Criminal (Ireland)—Return.

Session, 1857—1858.

98 D. Poor Rates and Pauperism—Return (D).

Delivered on 13th, 16th, and 17th June, 1859.

18. Court of Chancery (State of the Suitors' Fund)—Return.
20. Army (Receipt and Expenditure)—Account.
2. Justices of the Peace—Return.
3. County Courts—Return
5. Dwelling Houses (Scotland)—Return.
13. Universities (Scotland)—Ordinance (Glasgow).
14. Universities (Scotland)—do. (St. Andrew's).
15. Bonding Warehouses—Return.
21. Army (Relatives of Deceased Officers)—Statement of Sums paid.
22. Army (Officers on Half Pay, &c.)—Return.
27. Merchant Seamen's Fund—Account.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July 8th*, 1859.]

Dated 21st June, 1859.

1488. G. Tomkins, Pontymister, near Newport, Monmouthshire—Imp. in coating metals and in the apparatus connected therewith.
1490. S. Gibbs, Eddington, Herne, near Canterbury—Imp. in apparatus for slinging horses, mules, and other animals.
1492. J. Meikle, 79, Rumford street, Glasgow—Imp. in coating iron ships with asphalte, which improvements are also applicable to coating other surfaces.
1496. E. Oliver, King William-street—Improved medicinal mixtures for the cure of rheumatism, tic-doloreux, lumbago, cramp, sciatica, and such like complaints.

Dated 22nd June, 1859.

1502. W. Goulding, Leicester—Imp. in the construction of ploughs.
1504. W. Russell, Leicester—Imp. in wheels for ploughs, cultivators, and other implements or carriages.
1506. J. Apperly and W. Clissold, Dudbridge, Gloucestershire—Imp. in the manufacture of wheels for carriages and engines.

Dated 23rd June, 1859.

1508. J. Luis, 1B, Welbeck-street, Cavendish-square—A machine for corking bottles. (A com.)
1509. C. F. Varley, 4, Fortess-terrace, Kentish-town, and C. J. Varley, 7, York-place, Kentish-town, St. Pancras—Imp. in proving electric conductors, and in the apparatus connected therewith.
1511. E. T. Hughes, 123, Chancery-lane—Imp. in the manufacture of artificial sandstone, bricks, tiles, and similar articles. (A com.)
1513. A. Prince, 4, Trafalgar-square, Charing-cross—Imp. in alarum locks and latches.
1514. H. Doulton, Lambeth—Imp. in earthenware jars and bottles.
1515. A. V. Newton, 66, Chancery-lane—Imp. in springs for resisting sudden and continuous pressure. (A com.)

Dated 24th June, 1859.

1516. W. Lister, jun., and T. G. Garrick, Sunderland—Imp. in ships' windlasses and other like apparatuses, applicable also to the steering of ships.
1517. J. Mills, Heaton Norris, Lancashire—Imp. in the manufacture of keys and gibs, and in the machinery employed therein.
1518. A. Chesneau, 29, Boulevart St. Martin, Paris—Imp. in paddle-wheels.
1519. W. Clark, 53, Chancery-lane—Imp. in sewing machines. (A com.)
1520. G. Redrup, Loughborough, Leicestershire—Machinery for the cutting of shives, bungs, corks, spiles, and vent or other pegs.
1521. R. Hornsby, jun., Spittlegate Iron Works, Grantham, Lincolnshire—Imp. in ploughs and in giving motion to ploughs and other agricultural implements by steam power.
1522. P. Faure and J. Pernod, Avignon, France—An improved process for utilising the residues of madder in the manufacture of garancine and other preparations of madder.
1523. J. Drury, Exley, near Halifax—Imp. in steam engines and boilers.

Dated 25th June, 1859.

1524. T. Howard, King and Queen Iron Works, Rotherhithe—Imp. in condensing steam in engines where superheated steam is used.
1525. W. J. Sluce, Bethnal Green-road, O. Murrell, Edward-street, Bethnal Green-road, and W. Hudson, Hackney-road, Middlesex—An improved method of generating steam.
1526. C. Wye Williams, Liverpool—Imp. in steam boilers.
1527. W. E. Newton, 66, Chancery-lane—Apparatus for exhibiting stereoscopic pictures. (A com.)
1528. J. Roberts, Upnor, Kent—Imp. in filters.
1529. J. Boden, Portswood road, and W. Clark, Northern-road, Southampton—Imp. in apparatus for superheating steam.
1530. S. Russell, Sheffield—Imp. in breech-loading fire-arms, and in projectiles to be used therewith.
1531. W. Coppin, Londonderry—Imp. in apparatus for raising sunken and stranded vessels and their cargoes, and for raising and lowering other bodies into, and out of, the water, part of which improvements are applicable to raising weights generally.

Dated 27th June, 1859.

1533. G. Wrigley, Chester, and T. H. Wrigley, Mossley, Yorkshire—Imp. in self-acting mules for spinning and doubling.
1534. D. J. Fleetwood, Birmingham—An imp. or imps. in shaping metals.
1535. R. Burton, Brooklyn, U.S.—Imp. in breech-loading fire-arms.
1536. G. Smith, Buttermilk Falls, Orange County, U.S.—An improved construction of primer for fire-arms.
1537. T. Leigh and J. Line, St. Mary Cray, Kent—An imp. in paper-making machinery.

Dated 28th June, 1859.

1540. A. V. Newton, 66, Chancery-lane—Improved machinery for cutting corks. (A com.)

Invention with complete Specification Filed.

1561. L. L. Tower, Massachusetts, U.S.—A new and useful machine for dampening and wetting paper, &c. (A com.)—30th June, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, July 8th*, 1859.]

July 8th.

69. J. T. Forster.
72. R. D. Clegg.
83. W. Tillie.
84. D. E. Hughes.
87. C. W. Siemens.
88. F. Versmann and A. Oppenheim.
89. N. P. Burgh.
92. W. Oliver.
103. C. Beslay.
105. R. A. Lightoller.
118. T. Herbert & E. Whitaker.
126. J. Dauglish.
181. J. Latimer Clark and J. Muirhead.
211. R. Mushet.
236. I. Hammond.
265. J. Lane.
278. J. P. Booth.
497. G. Turnbull.
1083. J. Toussaint.
1153. R. Pearsall.
1155. R. D. Kay.
1203. J. H. Johnson.

[*From Gazette July 12th*, 1859.]

July 12th.

106. W. Bennetts.
110. J. Picksley and R. Sims.
112. D. L. Banks.
113. J. J. Stevens.
114. F. J. Manceaux and E. N. Vieillard.
115. J. Grist.
122. S. Holt.
125. W. Davis.
131. D. L. Banks.
431. W. E. Newton.
499 J. Robinson.
899. R. Wappenstein.
339. E. Partridge.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, July 8th*, 1859.]

July 4th.

1578. J. Lewtas and J. Humphreys.
1583. L. Blackstone.

July 5th.

1587. A. L. S. Chenot and E. C. A. Chenot.
1588. A. L. S. Chenot and E. C. A. Chenot.
1589. A. L. S. Chenot and E. C. A. Chenot.
1590. A. L. S. Chenot and E. C. A. Chenot.
1595. W. Laing.

[*From Gazette, July 12th*, 1859.]

July 7th.

1586. R. Shaw.
1616. W. B. Adams.
1647. W. B. Adams.

July 8th.

1622. T. Jerome.
1661. W. Watt.

July 9th.

1638. R. Harrington.

Journal of the Society of Arts.

FRIDAY, JULY 22, 1859.

ON WATER-GLASS, AND ITS APPLICATION TO THE ARTS AND MANUFACTURES.

By Frederick Ransome, C.E., Ipswich.

The articles upon the subject of Water Glass, by Dr. Fuchs, which have recently appeared in the *Journal of the Society of Arts* of the 17th and 24th of June last, and the recent report of the Commission of the French Government on the experiments of Professor Kuhlmann,* would lead to the conclusion that the important subject of silicification and the various applications of soluble glass are comparatively unknown in this country, the more so, as no reference whatever is made either in the report or the articles in question to English discoveries and manufactures dependent upon the same principles.

As the inventor and patentee of various processes, in every respect analogous and almost identical with those suggested in the articles alluded to; as having, during the last fifteen years, occupied myself exclusively in modifying and improving the manufacture, and applying successfully on a large scale, the soluble glass to various useful purposes previously unknown in this country, I may be allowed to claim the attention of the Society of Arts to the great injustice of bringing so prominently forward as a novelty, in so important a scientific journal, the history and results of experiments conducted by foreign chemists in the manufacture and use of a material for which *I received the Telford Medal of the Institution of Civil Engineers, in* 1848; *a Prize Medal from the Jury of the Great Exhibition in* 1851; and which I have been manufacturing at the rate of many tons per week at my own works, and more lately at those of the Patent Silicious Stone Company, at Ipswich.

My own attention was first directed to the subject in the year 1844, when carrying out a series of experiments with a view to the production of an artificial stone suitable for grinding, building, and ornamental purposes, which should possess all the advantages, and be free from many of the defects of the natural stones hitherto in use. I found that with few exceptions the hardest and most durable stones were those containing the largest proportion of silica, and I at length succeeded in producing a compact stone by combining or cementing the particles of silicious sand by means of a silicious paste or cement, for which I secured a patent bearing date 25th of October, 1844. In preparing this silicious paste or cement, I first dissolved soda or potash in water, which I rendered caustic by means of lime. Then, under the influence of steam pressure in an iron boiler, I dissolved broken flints in the caustic soda or potash until I obtained a silicate adapted to the purposes required. This silicate I afterwards mixed with the requisite quantity of sand, broken stone, or other silicious matter, which, after being moulded into the desired form, was placed in a kiln and raised to a bright red heat. By this last operation, the soluble silicate, by combining with additional silica, was converted into an insoluble compound, and a stone was produced resembling, both in appearance and characteristics, the best descriptions of natural sandstone.

I was not at that time aware of the memoirs published by Dr. Fuchs, in Kastner's Archiv, for 1825; nor of the further researches either by him or Professor Kuhlmann; nor have I yet learned that either of those gentlemen attempted, or even contemplated, the manufacture of stone by such process, but, on the other hand, I may be allowed to state that I secured a patent in France for this very process in the year 1845.

I soon, however, discovered, that owing to the presence of a portion of sulphate of soda, an efflorescence of this salt was likely to take place on the surface of the artificial stone thus made, when exposed to the weather, which greatly diminished the value of the article in its application to architectural and ornamental purposes, but it was not until the year 1853, after many discouragements, and a series of experiments involving a large outlay of money, that I discovered the means of preventing this efflorescence by the use of a solution of baryta, and thus succeeded in perfecting the manufacture of an article which has now received the approval of some of our most eminent architects, chemists, and geologists.

In the year 1845 I obtained letters patent in England, Scotland, and Ireland, for the application of a soluble silicate for combining small coal into blocks, and for preserving wood from fire and decay.

In the year 1854, and still without any knowledge of the work done by Dr. Fuchs or Professor Kuhlmann, I invented a process for "preparing oxides and carbonates of lead or zinc," "and carbonates or sulphates of barytes with soluble silica," either with or without being "mixed with colouring or other matter," and enrolled a provisional specification, intending to complete the patent for the same, but owing to an attack of illness I was prevented from obtaining this protection.

In the year 1855 I claimed and obtained a patent for further improvements in the manufacture of artificial stone; and, lastly, in 1856, I invented and patented a process for preserving natural or artificial stone and other building materials, and rendering them less liable to decay. At this time I was made aware that a soluble silicate of potash or soda had been for sometime past employed upon the Continent for the purpose of preserving the stone of some public buildings, but I found in carrying out my operations, that although this process had been favourably reported upon in France, and that, under certain conditions, an apparently satisfactory effect was sometimes produced, yet it was nevertheless very imperfect. The general results, as obtained by the application of the simple silicate in our own country, being very uncertain, it appeared to me that one great cause of failure arose from the fact that the silicate being applied in a soluble form, it was liable to be removed from the surface by rain, or even by the humidity of the atmosphere, before the alkali of the silicate could absorb sufficient carbonic acid to precipitate the silica in an insoluble form. But another great and serious defect in this process still existed, viz., that even were it possible to effect the precipitation of the silica, still it would be simply in the form of a gelatinous hydrate possessing no cohesive properties in itself, and, therefore, capable of affording but little (if any) real protection to the stone. It seemed to me, therefore, necessary not only to adopt a process which should ensure an insoluble precipitate independently of the partial and uncertain action of the atmosphere, but that to render such a means efficient, a much more tenacious substance than merely precipitated silica must be introduced, and, in the course of my experiments I found that by the application of a second solution, composed of chloride of calcium, *a silicate of lime* would immediately be produced, possessing the strongest cohesive properties, and perfectly indestructible by atmospheric influences.

The mode of application is simply this:—The stone or other material of which a building may be composed should be first cleaned, by the removal of any extraneous matter from the surface, and then brushed over with a solution of silicate of soda or potash (the specific gravity of which may be varied to suit the nature of the stone, &c.); when dry, this is followed by a solution of chloride of calcium, applied also with a brush; the lime immediately combines with the silica, forming silicate of lime in the pores of the stone, whilst the chlorine combines with the soda, forming chloride of sodium, or common salt, which is removed at once by an excess of water. Experience has shown that when the silica is once applied to the stone in this manner, it is impossible to remove it unless with the surface of the stone itself.

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* See last No. of *Journal*, p. 584.

The application of this process, which I also patented in France, in March, 1857, has, in every instance in which I have operated, been attended with the most satisfactory results; decay has been prevented in the softest and most friable stones, and where disintegration had commenced prior to its use, this has been at once arrested, and the same stones rendered perfectly hard and durable.

Amongst other buildings which have been satisfactorily treated by this process, I may allude to the Baptist Chapel in Bloomsbury, the Royal Pavilion at Brighton, and the Custom-house at Greenock, in each of which buildings the stone which before was seriously decomposed is now hard, and I have every reason to believe is permanently preserved, whereas I am not aware of a single instance in which the application of the silicate of potash, or water-glass alone, has proved beneficial in effectually preserving the stone of any public building in this country.

I would further observe that my various inventions and improvements have been the result of observations made in the actual manufacture and use of the soluble silicate, and that this material is now and has long been largely used in this country for the purposes already described, as also in several other important branches of manufacture. It is not my desire to detract from the value of the results obtained by Dr. Fuchs and Professor Kuhlmann's indefatigable and persevering investigations, which unquestionably have conferred great and lasting benefits upon the community at large; but having (as I think I have satisfactorily shown) devoted so large a portion of my life, and embarked a considerable outlay of money in conducting similar experiments, and bringing the same to a successful and practical application in this country, to the future development of which, and to the just recognition of my claims by the public, I naturally look for a return; I feel it due to myself and the interests of my family that my position shall be clearly understood, and with this view I appeal to the Society of Arts, so that, whilst extending through their *Journal* the knowledge of the valuable researches and discoveries of men of science in other countries, they may not unconsciously commit an act of injustice towards the inventors of our own land.

Ipswich, July, 1859.

P.S.—I append copies of reports I have received from Professors Henry, Ansted, and Hunt.

(Report by Professor T. H. Henry, F.R.S., &c.)

Dear Sir,—I have carefully examined your process for the "Preservation of Stone," &c., and I believe it to be in all respects calculated to answer the purpose intended.

It is known to chemists that silicate of lime is one of the substances best adapted to resist both the influence of the atmosphere and also the action of sea water. The affinity of silica for lime is so great, that if a piece of clay very gently calcined, or a little gelatinous silica be placed in a solution of lime water, the whole of the lime is quickly abstracted from the solution, and enters into solid combination with the silica, forming an insoluble silicate of lime. This is precisely the substance you form in the very pores, and upon the surface of the stone. It is a tough substance, is not friable, and is not acted upon by carbonic acid or by dilute acids generally.

I found that pieces of Bath stone, when placed in very dilute sulphuric acid, were soon deeply corroded, and universally over the whole surface, whereas the same stone placed in the acid for an equal length of time, after having been subjected to your protective treatment, was entirely unacted upon, retaining all its sharpness of outline, and having lost nothing in weight. Each stone similarly treated was found to resist the action of the acid completely, whereas when unprotected by your process, it was entirely broken up, falling into fragments.

I believe you have hit upon the right substance for protecting stone from decay; it is identically the same that has conferred durability upon the old Roman mortar still unchanged after two thousand years, and upon the hydraulic cement with which the foundation of the Eddystone Lighthouse was built after the numerous interesting experiments of Smeaton on the subject.

I repeat, therefore, that I consider your process to be by far the best hitherto proposed, and I think it would be impossible to obtain such evidence of the durability of any other artificial substance capable of being applied to the surface of stone for its preservation.

Yours, truly,
(Signed) T. H. HENRY, F.R.S., &c.
To Mr. Frederick Ransome.

(Report by Professor D. T. Ansted, M.A., F.R.S., &c.)

The process adopted by Mr. Frederick Ransome for preserving soft or porous stones used for construction, whether fresh, or already in a partially decomposed state, appears to me to be founded on correct principles, and has succeeded hitherto in every case, so far as I am informed, in which it has been fairly tried. Taking advantage of the very peculiarity of structure of the stone itself which renders it destructible, viz., its absorbing power, it introduces into the pores a mineral substance soluble in water; and then, by allowing the stone to absorb a second preparation, also soluble, a complete double decomposition takes place, and a perfectly insoluble and non-absorbent film is formed and left behind in the substance of the stone within its outer surface, which resists completely, not only the action of the weather, but all those acids contained in the atmosphere of large towns. The colour of the stone can be imitated in the preparation without in the least affecting the result, and the induration appears to be of such a nature, that it might be used with equal success in the temperate damp climate of our own country, in perfectly dry climates, or in hot moist climates in the tropics.

It is also equally applicable to absorbent stones without regard to their mineral composition.

(Signed) D. T. ANSTED, M.A., F.R.S.
December, 1858.

(Report by Robert Hunt, Esq., M.A., F.R.S.)

The importance of the discovery of a process which could be relied on, for the preservation of the stones employed in the erection of our public and other buildings, has long been felt, and many experiments have been made in the hope of attaining this object. In London, and in several of the large towns in the provinces, I can point to buildings which have within a very few years, exhibited the most unmistakeable signs of decay. Layer after layer falls off, exposing a new surface to be freshly acted upon by the destroying agent, and thus, with comparative rapidity, the work of decay progresses; this has been referred to atmospheric causes, existing now as the result of our extensive manufactories, and greatly increased population, but to whatever cause the disintegration of the stone may be traced, certain it is, that scarcely any modern buildings whether constructed of the coal measure, sandstones, dolomites, oolites, or other well-known building stones, but exhibits in a few years after its completion lamentable evidences of decay.

My attention has been directed to the Baptist Chapel built by Sir Morton Peto, in Bloomsbury. For some time past the Caen stone used in this structure has been crumbling, especially where it was exposed to the action of water. The disintegration was proceeding so rapidly that it became necessary to give immediate attention to it. It was determined that Mr. Frederick Ransome should make an experiment upon the towers, where the stone was in a worse condition than in any other part. The result of this experiment was so satisfactory, that it was resolved that the entire building should be subjected to this process.

The most enduring stones in nature are those in which the cementing agent is silica, and it became a problem with the patentee to produce a true silicious surface upon any stones which appeared naturally liable to decay. All the sandstones are more or less porous consequently they absorb water readily; this is one great cause of their rapid disintegration. Availing himself of this, Mr. Ransome produces the desired results. First, the stone is made to absorb as much of a solution of the silicate of soda as possible; this being effected, it is washed with chloride of calcium. The play of chemical affinity is now brought into action in the stone, a double decomposition is effected, and insoluble silicate of lime fills the interstices;

chloride of sodium (common salt) being formed, which is readily removed. It will be evident to all, that since every particle of the stone to the depth penetrated by the solution, is surrounded by this silicate of soda, and that too—according to the law of surface action—in a concentrated form, that the silicate of lime which results from the action of the chloride on it, must completely fill the interstitial spaces, and thus render a stone, which was previously absorbent, absolutely non-absorbent.

It will be found that the stone surface of the Rev. W. Brock's chapel is now actually repellent of water, and that the hardness of the surface indicates a complete casing of the preservative silica. It should be distinctly understood that this process will not merely protect new stone from the influences of atmospheric action, but that it stops decay in stones already exfoliating, and preserves them from future action. Stones which have been in a state of rapid decomposition have been, for experiment, partially treated by this silicifying process. The result has been that the prepared parts have withstood the action of air, rain, and frost, showing no signs of injury, while the unprepared parts have completely broken up.

Beyond this, its preservative power, another advantage of the process is, that it can be applied to any stone without in the slightest degree affecting its colour or grain; all the natural conditions are preserved, and the hardening superinduced.

Now that a well-known public building has been treated by this process, the result can be observed by everyone. The rationale of the process alone—independently of the experiments which have been made—satisfies me that there is little chance of disintegration ensuing after the proper application of the solutions.

(Signed) ROBERT HUNT, M.A., F.R.S.

HISTORICAL ACCOUNT OF THE INTRODUCTION OF THE GALVANIC AND ELECTRO-MAGNETIC TELEGRAPH.[*]

By Dr. HAMEL, Member of the Imperial Academy of Sciences at St. Petersburg.

The art of telegraphing by means of galvanism and electro-magnetism is certainly the most interesting application of scientific acquirements ever made to purposes useful to society at large. By means of it, ere long, the inhabitants of the various parts of the globe will be able to correspond with each other, through oceans and seas, to a far greater extent than is probably within the expectation of most people.

I have taken considerable pains to find out the origin of the first telegraph made to work by a galvanic battery. Through it the Russian Baron Schilling was induced to follow with enthusiasm the art of telegraphing, and he subsequently made at St. Petersburg the first electro-magnetic telegraph, which, in a curious way, caused the introduction of such telegraphs in England.

That Soemmerring in Germany made a telegraph, in which the chemical action of the galvanic current on water produced the signals, is known, but nobody has taken the trouble to discover how he was induced to construct it. Even the time when it was made is nowhere accurately given. Sometimes it is stated wrongly by two, three, and, in one case, by nine years. It is surprising that the highly meritorious Steinheil, who lives in the very place where Soemmerring had made the first galvanic telegraph, errs likewise by two years. He also, like Poppe and Kohl, is not correct in his description of the apparatus.

From a minute and careful examination of the late Dr. Soemmerring's papers, I am enabled to show that on the sixth of August this year (1859) it will be half a century since the first galvano-electric telegraph was made.

Dr. Samuel Thomas von Soemmerring, born in 1755, at Thun, and deceased in 1830 at Frankfort-on-the-Maine, had studied at the University of Göttingen. In the year 1778 he travelled in Holland, England and Scotland. From 1779 till 1784 he was at Cassel, and from 1785 till 1796 at Mayence, Professor of Anatomy. From 1796 to 1805 he practised medicine in Frankfort, and from 1805 till 1820 he was a member of the Academy of Sciences at Munich, where the King of Bavaria had given him the title of Privy Counsellor. His great merits as an anatomist and physiologist are universally known.

Galvanism had interested him, like Humboldt and others, principally in the hope of being able to make its study useful to clear up some of the most mysterious portions of physiology. I find, however, that he had already, in November 1801, paid attention to the chemical action of the galvanic current. In January, 1808, he, together with another member of the Academy of Sciences at Munich, the well known chemist Gehlen, had made a communication to that academy in reference to the brilliant galvanico-chemical discoveries of Humphry Davy, at the laboratory of the Royal Institution in London.

It seems to me quite certain that an event in connexion with the war against France, brought on by Austria fifty years ago, in 1809, gave rise to the first galvano-electric telegraph.

The Austrian troops had on the 9th of April, 1809, begun to cross the river Inn, and so entered Bavaria quite unexpectedly. King Maximilian had hardly been informed of this, when he, on the 11th, with his family, in all haste, retired from Munich to the western frontier of his kingdom, to the town of Dillingen. He took with him Baron (soon afterwards created Count) Maximilian Joseph von Montgelas, who was then at the head of two important branches of administration in Bavaria—the foreign and the home departments.

By means of the line of Chappe's optico-mechanical telegraphs, established, already for some time, from the French frontiers to Paris, the Emperor Napoleon I. got information of this sudden aggressive movement of the Austrian troops much sooner than it was thought possible in the Austrian army, and he, without the least delay, started from Paris for Bavaria, on his way to the army. He came so totally unexpected to Dillingen, that he found King Maximilian in bed.

There is no doubt, that by the speedy arrival of the Emperor Napoleon I. in the midst of his army, Bavaria owed its delivery from the Austrians. Munich had been already, on the 16th of April, occupied by the Austrian general Jellachich, but he was, in less than a week after, on the 22nd, obliged to withdraw, and King Maximilian could again enter into his capital.

This event, so vitally important for Bavaria and for Munich, must there have directed special attention to the utility of telegraphs. The minister Montgelas had been witness of the surprise caused by the French Emperor's unexpected arrival at Dillingen. The Bavarian Academy of Sciences was in his department of administration, and Dr. Soemmerring, as one of its most celebrated members, was from time to time invited to come to dine with him at Bogenhausen, near Munich, where he lived.

This was the case on the 5th of July, 1809, when the minister expressed to him the wish to get from the Academy of Sciences proposals for telegraphs, having, as I allow myself to suppose, in view no other but optical (mechanical) telegraphs with improvements.

Soemmerring, referring to this dinner, noted in his diary only: "The minister wishes to get from the Academy proposals for telegraphs."

He at once resolved to try whether the visible evolution of gases from the decomposition of water by the action of the galvanic current might not be applied to telegraphic purposes, and three days after this dinner, he noted in his journal: "I could not rest till I realised the idea to make a telegraph by the evolution of gases."

On the 22nd of July, his apparatus was already so far advanced, that it was fit to work. He wrote: "At last the telegraph is finished;" also: "The new little telegraphic machine works well."

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[*] Some time since there appeared in the *Journal* two short extracts from Dr. Hamel's communications to the Imperial Academy of Sciences, at St. Petersburg, relating to the history of the introduction of the galvanic and electro-magnetic telegraph. Having now received from Dr. Hamel a detailed account of the results of his laborious researches on this interesting subject, the Editor has much pleasure in laying it before the readers of the *Journal*.

He, however, went on making still further improvements, and it was only on the 6th of August that he considered the telegraph quite completed. He was much pleased with its performance, being able to work through 724 feet of wire. He noted that day: "I tried the entirely finished apparatus, which completely answers my expectation. It works quick through wires having the length of twice 362 Prussian feet, so that the current passes along 724 feet."

Two days later, he could already telegraph through one thousand, and, on the 18th August, through as much as two thousand feet of wire.

On the 29th of August he exhibited the telegraph in action before a meeting of the Academy of Sciences at Munich.

He now wished to send his telegraph to the National Institute at Paris, and for doing so an apparently favourable opportunity presented itself.

An old acquaintance and scientific correspondent of Soemmerring, the chief surgeon of the French army, Baron Dominique Larrey, came on the 4th of November to Munich, on his return from the French army, which had been acting against the Austrians in the battles of Aspern, Esslingen, and particularly at Deutsch Wagram, near Vienna. He brought with him from the battlefields some interesting pathological objects for his friend's collections.

Soemmerring, of course, showed Larrey his telegraph, and the latter at once consented to take it with him to Paris. Next day Larrey even assisted at the packing.*

After Baron Larrey's departure from Munich, Soemmerring composed a description of his telegraphic apparatus in French, under the title: "Mémoire sur le Télégraphe," which, on the 12th of November, he forwarded to Larrey, in Paris. As he flattered himself that the Baron would find an opportunity to exhibit the telegraph before the Emperor Napoleon, he begged, in his letter, to be informed with what attention his Imperial Majesty might honour his invention. He also hoped that some members of the Institute might approve of it. Soemmering did not for a long time receive any account from Baron Larrey. At last the latter wrote that he had presented the telegraph in the beginning of 1810 to the Institute, but no resolution had been come to.

I have been permitted, in Paris, to examine the Journals of the Meetings of the Institute, and have found that Baron Larrey was in his letter—as also afterwards in a printed statement—incorrect with regard to the date; he presented the telegraph on the 5th December, 1809.

Under this date the following entry is made: "M. Larrey, au nom du Docteur Soemmerring, professeur à Munic, présente un télégraphe à pile galvanique qui peut servir la nuit." The Institute appointed Biot, Carnot, Charles, and Monge (who were all four present at the meeting) to examine the apparatus, and to report upon it, but, although I have carefully looked over all the journals for nearly two years following, I have found no report. Biot, the only surviving one of the four members appointed to examine the telegraph, and to whom I have spoken on the subject, cannot recollect the reason why no report was made. Soemmerring received his telegraph back on the 12th of May, 1811, full eighteen months after having intrusted it to Larrey.

The reason why Soemmerring's contrivance received so little attention in France, may have been that the optical telegraph lines, established by the Chappes, were considered to answer sufficiently well.

Larrey inserted in the number for April, 1810, of the "Bulletin de la Société médicale d'émulation," a notice of the telegraph, in which he speaks with much detail of the analogy which the many wires of the galvano-electric cord seemed to present with the single fibres of a nervous trunk, to which analogy Soemmerring had pointed in the Mémoire, prepared for Larrey, as well as in his original description of the telegraph printed in the "Denkschriften" of the Academy of Munich, for 1809 and 1810. Larrey's said article appeared again, nearly twenty years later (in November, 1829), in his "Clinique Chirurgicale."

In both these publications of Baron Larrey's the telegraph is placed in the midst of pathological and surgical subjects, where one would hardly look for an invention made for telegraphic purposes.

On the 9th of December, 1809, Ludwig Karl, then Crown Prince of Bavaria—who in 1825 became King, and abdicated in 1848—honoured Soemmerring with a visit. Unfortunately the new telegraph, which was to replace the original one taken by Larrey to Paris, was not yet quite ready to perform experiments with.

At the time when Soemmerring became a member of the Academy of Sciences at Munich, in 1805, there was attached to the Russian mission in that capital the Baron Pawel Lwowitsch Schilling (of Canstadt). About a year after the invention of the telegraph, on the 13th of August 1810, Schilling saw experiments performed with it. He was so forcibly struck with the probability of a very great usefulness of the invention, that from that day galvanism and its applications became one of his favourite studies. He brought many persons, from Russia as well as from other countries, to Soemmerring, that they might see his telegraph. The Russian minister, Prince Bariatinsky, repeatedly visited Soemmerring, and invited him to his house.

Ten days after Baron Schilling's first taking notice of the telegraph, on the 23rd of August, 1810, Soemmerring succeeded in inventing a contrivance for sounding an alarum, which answered perfectly well. He made the gas, rising in small bubbles from two of the wire points in the water, collect under a sort of inverted glass spoon at the end of a long lever, which, rising, made a second bent lever in the opposite direction, on the same axle, descend and throw off a little perforated leaden ball, stuck lightly on it, which, falling on an escapement, set the clockwork in action.

This alarum arrangement gave Soemmerring much pleasure, which he expressed in his journal with some detail. He wrote: "If the principal part of the telegraph gave me no trouble and demanded no alteration, but was ready in a few days, this secondary object, the alarum, cost me a great deal of reflection and many useless trials with wheelwork, which was driven by the streams of gas in the water to set the clockwork going, till at last I hit upon this very simple arrangement."

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* As Baron Larrey was the person who took the first galvano-electric telegraph ever made away from the place of its invention, I think it not improper to say here a few words in remembrance of this man, who has, during more than half a century, made himself useful in military hospitals and on fields of battle. To him the army owes the improved "ambulances volantes." He had begun his career, in 1788, by a voyage to Newfoundland, where the New World has recently been telegraphically, though not yet permanently, united with the Old, and ended in 1842 with a voyage to Algiers in Africa. The last of his numberless surgical operations he performed at Bona, to which place the cable from Europe through the Mediterranean Sea has lately been laid. He had accompanied Napoleon I. to Egypt, and made also, besides other campaigns, in 1812, the one to Moscow. During the battle at Wagram, near Vienna, which closed the Austrian campaign, Napoleon I. had, on the 6th July, 1809, (the day on which Soemmerring began to make his telegraph) created him a Baron, and subsequently at St. Helena, in his will, he left him one hundred thousand francs, adding, "C'est l'homme le plus vertueux que j'aie connu." In August and September, 1826, Baron Larrey had made a tour in England, Scotland and Ireland with his son Hippolyte, now Surgeon-in-Ordinary to the Emperor Napoleon III., whom he lately accompanied to Italy. He died in 1842. In the court before the former military hospital, now military medical school, Val de Grace, in the Rue St. Jacques, at Paris, where he had been long usefully active, his statue in bronze is placed on a monument, erected in 1850. Larrey is represented pressing Napoleon's last will against his heart. Of the four bas-reliefs on the pedestal, one refers to the campaign in Egypt, one to that in Spain, the third to the battle of Austerlitz in 1805, and the fourth to the dreadful passage of the French army over the river Berezina, on the retreat from Moscow in 1812.

Soemmerring's alarum has not become generally known, because it is not represented on the two plates which accompany the description of his telegraph in the Memoirs (Denkschriften) of the Munich Academy, published only in 1811. These plates were already engraved before the alarum was invented. The drawings were made by Christian Koeck, who had formerly, at Mayence, been Soemmerring's draftsman, but who now had just returned from Moscow, where he had been employed by Gotthelf Fischer for the Imperial Society of Naturalists.

On the 7th of September, 1810, Soemmerring called on Baron Schilling to invite him to his lodgings, in order that he might have the pleasure of showing him the action of the telegraph through wire carried round the whole house in which he then lived. It was Leyden's house, nearly opposite the Max Gate. The wires were first covered with a solution of india-rubber, and then varnished.

On the 25th October, the then newly-married Crown Princess of Bavaria, Princess Therese of Saxe-Hildburghausen, aunt to Her Imperial Highness the Grand Duchess Constantine of Russia, honoured Soemmerring with a visit to see his telegraph. She came accompanied by her mother, aunt to his Highness the Duke of Mecklenburg Strelitz, who is married to Her Imperial Highness the Grand Duchess Catherina Michailowna of Russia.

On the 6th of April 1811, a renowned warrior, General Erasmus Deroy, who in the following year, on the 18th of August, was mortally wounded near Polotzk, in Russia, where he died and lies buried, came accompanied not only by two aides-de-camp, but by several foreign Ministers, to see the action of Soemmerring's telegraph.[*]

On the 7th of May, Baron Schilling introduced to Soemmerring Baron Comeau, a Lieutenant-Colonel in the service of Bavaria, who repeated his visit on the following day, to get a thorough knowledge of the telegraph. I mention Baron Comeau's visit principally for the reason that he subsequently gave Soemmerring the first account of Schilling's operations with a subaqueous galvanic conducting cord through the river Neva, at St. Petersburg, in the year 1812.[†]

On the 14th of May, Baron Schilling introduced to Soemmerring Count Jeroslas Potozki, a Russian Colonel of the Engineer Corps, one of the many sons of Count Stanislas Felix Potozki. On the 20th, this Colonel saw experiments with the telegraph, and on the 25th he came again to request Soemmerring to let him have an apparatus, in order that he might be able to exhibit it at Vienna and at St. Petersburg. Soemmerring promised to get one ready.

On the 22nd May, the Minister Count Montgelas and his lady visited Soemmerring, to see experiments with his telegraph.

On the 5th of June, Baron Schilling proposed to Soemmerring to try the action of the telegraph whilst the two conducting cords were each interrupted by water contained in a wooden tub. The signals appeared just as well as if no water had been interposed, but they ceased as soon as the water in the two tubs was connected by a wire, the current then returning by this shorter way.

On the following two days, the 6th and the 7th June, Soemmerring made, together with Baron Schilling, first across a canal on the river Isar, and then along the river itself, experiments similar to those made by Galvani's nephew, Giovanni Aldini, in 1803, near Calais, in the sea, and near Charenton on the river Marne, not far from its junction with the Seine.[*]

At these experiments Count Potozki, and also the well known Bavarian engineers, Baader and Wiebeking, were present. Baader had seen the telegraph in Soemmerring's house on the 26th of May.

On the 9th of June, Soemmerring delivered to Count Potozki, the telegraph intended to be shown at Vienna and at St. Petersburg.

On the 5th of July, Count Potozki communicated to Soemmerring from Baaden, near Vienna, that he, on the 1st of that month, had had the honour to exhibit his telegraph in action before his Majesty the Emperor Francis I., the Empress, and the Archdukes Charles and John, who had all been highly pleased. ("Ils en furent enchantés.") The Emperor expressed his desire to have a telegraphic line established between the capital Vienna and his country palace Laxemburg (a distance of nine miles).

On the 28th July, the aeronaut Robertson saw experiments with Soemmering's telegraph. At his request he obtained an apparatus which he took with him to Paris.[†]

On the 22nd August, Prince Leopold of Saxe Coburg, now King of the Belgians, honoured Soemmerring with a visit to see the telegraph in action. He was accompanied by the Saxon Minister, Count Einsiedel.

In September, Soemmerring simplified his telegraph considerably; he reduced the number of wires in his conducting cord from 35 to 27.

On the 9th October, Baron Comeau had introduced the then Bavarian Minister at Paris, Anton de Cetto, to Soemmerring, that he might see the telegraph. He was accompanied by his son, now Bavarian Minister in London, Baron August de Cetto, who well recollects this visit.

On the 15th November, Soemmerring sent a newly made telegraph to his son Wilhelm, at Geneva, where he was at that time studying, and who is now a medical practitioner at Francfort.

The editors of the "Bibliothèque Britannique," August and Charles Pictet and M. Maurice, inserted a description of it in their journal, in which there are many errors, although Soemmerring had sent an account, drawn up by himself, along with the instrument. They printed that the telegraph was invented a few months before that time (the beginning of January), whereas the first telegraph had been made more than two years earlier.

Soemmerring had sent, along with Koeck's engraved plates of the telegraph apparatus, a drawing, made expressly for that purpose, by the same artist, of the alarum, but in the plate, done at Geneva, it is not correctly given. I am in possession of a faithful representation of this early alarum.

On the 28th and 29th November, Soemmerring had visits from Baron Alexander von Humboldt.

On the 1st of February, 1812, Prince Karl Theodor, the second son of King Maximilian I, honoured Soemmerring with a visit to see the telegraph.

On the 4th of February Soemmerring announced that he was able to telegraph through 4,000 feet of wire, and on the 15th March he telegraphed even through 10,000 feet.

In the spring of 1812, Baron Schilling was endeavouring to contrive a conducting cord, sufficiently insulated that it might convey the galvanic current, not only through wet earth, but also through long distances of water.

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[*] Two days after the General's death, Napoleon I., whose head-quarters were at a distance, had created him, by a rescript, Count of the Empire, and bestowed on him a dotation of 3,000 francs.

[†] Comeau had made, in 1812, as Colónel, the campaign of Russia, where he was wounded one day before General Deroy.

[*] A representation of the experiment made near Calais is given on plate 8, in Aldiné's book, "Essai théorique et expérimental sur le Galvanisme."

[†] This was the same Robertson with whose assistance the Imperial Academy of Sciences at St. Petersburg had, in the month of July, 1804, instituted a balloon ascent for scientific purposes, which was previous to Biot's and Gay-Lussac's ascent (on the 24th August), and Gay Lussac's (on the 16th September) in the same year. In the last (eighth) edition of the Encyclopædia Britannica (1853), it is erroneously stated, that the two latter ascents had been the first ever undertaken solely for objects of science.

The war then impending between France and Russia made Baron Schilling desirous of finding a means by which such a conducting cord should serve for telegraphic correspondence between fortified places and the field, and likewise for exploding powder-mines across rivers.

On the 8th of April Soemmerring wrote in his diary: "Schilling arrives, almost out of breath, with his idea about blowing up mines. Take care! Take care!"

On the following day Schilling came not less than four times to Soemmerring.

On the 13th May, Soemmerring wrote: "Schilling is quite childish about his electro-conducting cord."

On the 20th of July Schilling departed for St. Petersburg, as the Russian mission in Munich, on account of the then political circumstances, was dissolved. Soemmerring expressed in his diary the deep regret he felt at losing his interesting society.

In Russia Baron Schilling continued his endeavours to obtain the means necessary for being able to blow up powder mines without approaching them for the purpose, and even across rivers of considerable breadth, by the galvanic current. Not only had he already a subaqueous conductor, but he invented an ingenious, though simple, way of igniting the powder by means of pieces of charcoal, shaped in such a manner that they did not fail to produce the effect. In the autumn of 1812 he actually exploded powder mines across the river Neva, near St. Petersburg.

In 1813 Baron Schilling joined the army as "Staabsrittmeister" in a regiment of huzzars (the Ssoumsky regiment) and in 1814 he was active in the engagements near Bar-sur-Aube on the 27th February, near Arcis-sur-Aube on the 20th and 21st, near Fere Champenoise on the 25th, and in that close to Paris on the 30th March. On the following day he entered Paris with the Russian and allied troops, headed by the Emperor Alexander I.

Baron Schilling has told me that during his stay at Paris he, with his subaqueous conductor several times, to the astonishment of the lookers-on, ignited gunpowder across the river Seine.

In one of Soemmerring's later letters to Baron Schilling, he, alluding to his subaqueous conductor, says that the means found out by him (Schilling) to ignite, by the galvanic current, gunpowder at a distance (das Fernzünden) were more difficult to discover than his, Soemmerring's, signalising at a distance (das Fernzeichengeben).

After Baron Schilling's departure from Munich, in 1812, Soemmerring occupied himself less with the telegraph. His attention was directed to the dry voltaic pile, called after the Abbé Zamboni, who had made the first at Verona, where it was placed in the cabinet of the Vice-Roy of Italy, Eugene Beauharnois, afterwards Duke of Leuchtenberg.

From this pile, the action of which was considered, so to speak, perpetual, at that time great things were expected. Dr. Assalini, the surgeon of His Highness, who, like Larrey, had been with Napoleon I. in Egypt, and in 1812, with Prince Eugene, in Russia (where he got his feet frozen), was in June and July 1814 a good deal with Soemmerring at Munich. He printed there a description of "the perpetual (immerwährender) electromotor." On the 14th of June he exhibited to the Academy of Sciences a pair of piles, belonging to his Highness the Vice-Roy.

On the 2nd October, Soemmerring showed the telegraph to two well-known scientific gentlemen, Professor Pfaff and Dr. Jager.

On the 8th of May, 1815, he had the honour of a visit from the late Empress of Russia, Elizabeth Alexejewna. Her Imperial Majesty was accompanied by the King and Queen of Bavaria. Among other galvanic apparatus, Soemmerring showed their Majesties a second-striking pendulum clock, set in motion by Zamboni's dry piles, which had just then been made by Aloys Ramis, the mechanic in the employ of the Academy of Sciences.

On the 17th of July Baron Schilling came, quite unexpected, again to Munich. He was now anxious to acquire every information about a useful art that had been developed at Munich, namely, the art of lithography, in order to introduce it in Russia. Four days after his arrival, Schilling introduced Soemmerring to Count Fedor Petrovitch Von der Pahlen, then lately appointed minister from Russia. Soemmerring accompanied his Excellency that day to the Academy, that he might see the cabinet of natural philosophy and other collections. Count Pahlen showed himself as friendly to Soemmerring as Prince Bariatinsky had done formerly. Not only did he come himself to study the telegraph, but he brought, for that purpose, many other persons to Soemmerring.

On the 29th December there came to pay his respects to Soemmerring, while Baron Schilling was just with him, the well known natural philosopher, Johann Salomon Christian Schweigger, then professor of natural philosophy and chemistry at the physico-technical Institute, (Realinstitut), at Nürnberg, who was on his way to Paris and London, in which latter place I had afterwards the pleasure of making his acquaintance.

Soemmerring showed Schweigger the next morning the telegraph, of which he had in the year 1811, immediately after the appearance of its description in the "Denkschriften" of the Munich Academy, inserted an account in the "Journal für Chemie und Physik," which he had, since the commencement of the year mentioned (1811), edited. In the remarks, there added by Schweigger, he had found fault with Soemmerring, for not having indicated any means of calling at the distant station the attention of the clerk to the instrument, when a message was to be sent, and he proposed, for that purpose, to fire voltaic gas pistols.

We have seen that Soemmerring had succeeded in making an alarum soon after his description of the telegraph had been printed in the "Denkschriften," although not yet published. Schweigger was now pleased to see this alarum, and lost no time in getting it announced in his above named Journal.

It may not be out of place here to remark, that the worthy Abbé Moigno, in his "Traité de Télégraphie électrique" of 1852, is in error, when he (page 64) says that Schweigger had given the account of Soemmerring's telegraph, and made his remarks about the want of an alarum in the year 1838, in the "Polytechnisches Central Blatt," which, in the Abbé's opinion, Schweigger edited. This journal was edited by Julius Ambrosîus Hülsse, teacher of mathematics, natural philosophy, and technology, at the commercial school at Leipzig. It contains an article on the electro-magnetic telegraph by Hülsse, which however does not treat on the subject the Abbé refers to. Schweigger had inserted the description of Soemmerring's telegraph, and made his remarks in the above cited "Journal für Chemie und Physik," not less than 27 years earlier, in 1811. In 1838 Schweigger had been already nine years in his grave.

Baron Schilling, having made at Soemmerring's the acquaintance of Schweigger, of course could not foresee that one day an invention of this gentleman, the multiplier, would enable him to make at St. Petersburg the first electro-magnetic telegraph.

Schweigger dined with Soemmerring and Schilling together at the so-called Museum, a sort of club, where many of the scientific persons of Munich used to meet, and where, in 1810, Baron Schilling had first become more intimately acquainted with Soemmerring.

On the 2nd of January, 1816, several experiments were made with Zamboni's pile. The most interesting were those relating to the action of the sparks from it on the air. Schweigger, who had himself in Nürnberg paid attention to Zamboni's pile, wrote afterwards to Soemmerring from Paris (10th May, 1816) that there the dry pile was regarded more as a plaything, but that Gay-Lussac had heard with interest the account he had given him about Soemmerring's experiments regarding the effect of the sparks from it on the atmospheric air.

Baron Schilling was now a good deal with Aloys Senefelder, the inventor of lithography, and also with Professor Mitterer, who directed an establishment for that art in Munich.*

In February, 1816, Dr. Thomas Thomson printed, in the Annals of Philosophy, that Dr. Redman Coxe, Professor of Chemistry at Philadelphia, in the United States, had informed him that he contemplated galvanism as a probable means of establishing telegraphic communications, and nominally by the evolution of gases from water. Coxe promised to follow up the idea, but he added that it would demand time. The Abbé Moigno, at Paris, states in both editions of his Traité de Télégraphie électrique (1849 and 1852) erroneously the year 1810 instead of 1816 for the announcement of Coxe's idea.

Dr. Thomson did not know that Coxe came six years and a-half too late with his idea. Soemmerring, at Munich, had, in 1809, executed, what Coxe in Philadelphia, in 1816, hoped in time to do, although it appeared to him, as he expressed it, a fanciful speculation.

On the 2nd of July, 1816, Baron Schilling introduced the British Envoy and Minister Plenipotentiary at Munich, the Hon. Frederic James Lamb—youngest brother to Lady Palmerston—to Soemmerring, in order that he might acquire a knowledge of his telegraph. Ten days later, on the 12th, he accompanied him again there to see the telegraph in operation. On this occasion were present: Baron Schilling's sister, the Countess Banfy, and her husband, Count Banfy. They resided at Vienna, but were then on a visit to Munich.

The Hon. F. J. Lamb was subsequently more than ten years British Ambassador at Vienna, where he married the daughter of the Prussian minister there, Count Maltzahn. In 1841, he had been created Baron Beauvale, and, in 1848, he succeeded his elder brother, the second Viscount Melbourne, who had been so many years Prime Minister of England, and after whom the capital of the colony Victoria in Australia, yielding so much gold, is named. He died on the 29th January, 1853. Soon after that time, Messrs. Butcher and McGowan had come from Canada to Melbourne with the intention of establishing telegraph lines in Australia. The first line was opened on the 3rd of March, 1854, from Melbourne to Williamstown; other lines in Victoria soon followed, and since last November (1858), the capitals of New South Wales and of South Australia (Sydney and Adelaide) are telegraphically united with that of Victoria (Melbourne). Ere long these lines will be joined to others in Tasmania, by means of a submarine cable to be laid across Bass's Strait.

So we know now, that the Honourable Francis James Lamb, third Viscount Melbourne, brother to Lady Palmerston, was the first Englishman that ever saw a telegraph put in action by a galvanic battery, and that it was the Russian Baron Schilling who invited him to take notice of it.

A Mr. John Robert Sharp, residing at Doe Hill, in Derbyshire, having read in the number for February 1816 of the "Repertory of Arts," a short account of Soemmerring's invention (taken from the "Denkschriften" of the Academy of Sciences at Munich, which were published in 1811) announced in the number for June of that same journal, that in 1813 he had made before the Lords of the Admiralty an experiment showing that the voltaic current might serve for telegraphic purposes. Mr. Sharpe did not know that Soemmerring had already made his telegraph in the year 1809, and, perhaps supposing it might have been made only in the year 1813, he adds, that he did not mean to raise doubts as to the originality of Soemmerring's invention.

On the 24th March, 1818, Baron Schilling wrote to Soemmerring to announce to him that his Majesty the Emperor Alexander I. had made him a Knight of the Order of St. Anne of the second class. In the following year (3rd November, 1819), the Imperial Academy of Sciences at St. Petersburg elected Soemmerring an honorary member.

Soon after the Congress of Aix la Chapelle, on the 7th December, 1818, Count Capo d'Istria, and on the 22nd of the same month, Prince Alexander Sergejewitch Menschikoff, came with Count Pahlen to Soemmerring, to see experiments with the telegraph.

These visits gave Soemmerring much pleasure. He wrote to Schilling about Count Capo d'Istria:—"Never has any body, except yourself, at the first glance comprehended every thing so clearly, and conceived how easily the telegraph might be applied on a large scale."

In 1819 there was a prospect of Soemmerring's telegraph being brought to London.

Already, on the 3rd of June, 1817, Count Arco, brother to the Countess Montgelas, had introduced to Soemmerring Lionel Hervey,* then lately appointed British Secretary of Legation at Munich, in order that he might have an opportunity of seeing the telegraph.

In 1819, on the 10th of May, when Soemmerring was about to go for a time to Frankfort, Count Arco informed him that Hervey wished to pay him another visit.

They both came two days after, and Soemmerring explained to Hervey the telegraph in all its details. On the 17th Hervey came again alone, and expressed his wish to get such a telegraph for England.

Soemmerring sent him the complete apparatus on the 25th May, and added an instruction, in English, about the way of using it. He expressed the hope "that Sir Humphry Davy would receive the telegraph favourably, perhaps improve it, and further its application to use in Great Britain."

After Soemmerring's return from Frankfort—where I had the pleasure of paying him my respects—he learned on the 20th May, 1820, that Hervey had not sent the telegraph to England. He got it back with the strange remark, that Hervey had not forwarded it, fearing difficulties at the custom house!

(*To be continued.*)

HORTICULTURAL SOCIETY OF LONDON.

A second special meeting of the members of this Society, for the purpose of considering the steps taken by the Council, with the view of obtaining a site for a garden at Kensington-gore, was held on Wednesday morning, in the Great Room of the Society of Arts, the Earl of Ducie in the chair.

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* In May, 1816, Soemmerring accompanied Baron Schilling to Solenhofen, near Eichstadt, where the best lithographic stones are quarried. He got here organic fossils for his collections. Already in 1810 he had described the interesting animal which he, from the likeness of its head with that of a bird, called Ornithocephalus, and which he considered to be a mammal, a bat, from which opinion, however, Cuvier differed, taking it to be a reptile, and calling it Pterodactylus. Later Soemmerring described a similar animal, which he named Ornithocephalus brevirostris, the former being longirostris; also two others, Crocodilus priscus, and Lacerta gigantea. The first described Ornithocephalus remained as one of the most remarkable objects in the Museum at Munich, where Agassiz, when studying medicine at that place, was, in 1828, first led to the study of fossils, in which department he subsequently succeeded in accomplishing so much. A cast in plaster of Paris of the Ornithocephalus longirostris, which Soemmerring had shown me in 1819 in Frankfort, where he then lived for a time, I have now seen again in the British Museum in London, besides other fossils that were in Soemmerring's possession.

* Lionel Charles Hervey was the grandson of one of the sons of John Hervey, who, in 1714, was created Earl of Bristol. His elder brother, Felton, had, in 1801, adopted the name of Bathurst, in addition to that of Hervey. In Dod's "Baronetage" it is erroneously stated, that Bathurst had adopted the name of Hervey. He was Aide-de-Camp to the Duke of Wellington at Waterloo, and is one of those who signed the important Convention at Paris, on the 3rd July, 1815. Lionel Hervey was, from 1820 till 1823, Secretary of Legation, officiating also, for a time, as Minister, at Madrid; he died in 1843.

On opening the proceedings, the Chairman, after referring to the statement which was made by the Council at the last meeting (of which an account appeared in the *Journal* for the 8th inst., p. 579), said that he was most happy to inform the meeting that certain modifications in the proposed lease had been agreed to by the Royal Commissioners, on terms much more beneficial to the Society and the interests of the public. It gave him much gratification to inform them that, although no exertions had as yet been made to raise the necessary funds, £11,000 and upwards had been already subscribed to forward the objects the Society had in view. He would conclude by observing that in regard to the plans for the new garden, the Society were not pledged to carry them out in all their details, and that the Council would exercise every precaution in fixing upon such as would meet the approbation of all by their general excellence. The Secretary then read the list of subscriptions which had been received, and the names of those who had become members, together with those who had taken the debentures of the society. Among the subscribers the name of Her Majesty appeared for £1,000, that of the Prince Consort for £500, while all the Royal children were enrolled as life members. The Prince Consort, in addition to his subscription, has taken debentures to the value of £500. The list amounted to more than £11,000. The secretary then proceeded to explain to the meeting what steps had been taken with the Royal Commissioners in regard to the renewal of the lease, and read a letter from the commissioners, from which it appears that the commissioners will be willing to renew the lease for a similar period and upon the same terms as to rent and management as at present, upon the following conditions:—1. That two years' notice must be given previously to the expiration of the first lease; 2. That the commissioners shall reserve to themselves a power to decline to renew the lease upon taking on themselves the responsibility of any debentures of the society that may be outstanding at the expiration of the 31 years, to any extent not exceeding a maximum of £20,000; 3. That the society shall agree to devote in each year, during the continuance of the lease, not less than 50 per cent. of the moiety of the net surplus balance of the receipts (after the commissioners' claim for rent is satisfied) for the purpose of paying off outstanding debentures; 4. That in the event of the society being unable for five consecutive years to pay the interest on the £50,000 borrowed by the commissioners, the commissioners shall have the right of re-entry without payment of compensation to the society; and lastly, that the society shall not underlet or dispose of their lease without the consent of the commissioners. A conversation then took place as to the propriety of accepting the offers of the commissioners, the principal topic of disagreement being as to the right of re-entry if the society failed to pay the interest on the £50,000 for five consecutive years, during which, in answer to various questions, the secretary stated that the council had resolved that the debentures should be of the value of £100 each, bearing interest at 5 per cent., payable half-yearly, and that the holders of debentures would have a free admission to the gardens. He explained the difference of the privileges of subscribers of 40 and 20 guineas, the means that would be adopted for paying the interest on the £50,000, and informed the meeting that in respect to the society's gardens at Chiswick, the Duke of Devonshire had expressed his willingness to take from the society any portions of the ground they might think fit, and to allow them to retain what would be necessary for their purpose, and that under the conditions of the Chiswick lease the society had the right of moving all buildings requisite for plants, and all plants that might be moved without damage. The following resolution, moved by Sir Philip Egerton, and seconded by the Duke of Leinster, was then read:—

> "That this meeting approves of the steps already taken by the Council, authorizes the negotiations with the Royal Commissioners to be continued, and empowers the Council to proceed to raise the sum required for the construction of a garden at Kensington Gore, and if the money shall be obtained, to complete the arrangements."

A long discussion ensued before this resolution, which was ultimately carried unanimously, was adopted, in which Sir Joseph Paxton took a prominent part, insisting that the conditions of the commissioners, as altered, were infinitely worse than before, and concluding his speech with a motion that the meeting adjourn until this day fortnight, in order to give time for further communications between the Society and the Royal Commissioners. He subsequently, after a long discussion, withdrew his motion, and proposed that the following instruction, which was carried unanimously, should be addressed to the Council:—"That the Council be instructed not to accept the clause about re-entry in case of failing to pay interest for five years, and that in the event of the commission cancelling the lease an equitable arrangement of mutual interests be made." The Duke of Leinster then proposed a vote of thanks to the chairman, which having been unanimously agreed to, the meeting separated.

The drawings and plans of the proposed garden are still at the House of the Society of Arts for inspection.

NEW ZEALAND FLAX.

The following announcement has recently been made by the Government of New Zealand, extending for two years the time within which the rewards offered may be claimed:—

Colonial Secretary's Office, Auckland, 19th March, 1859.

The Government of New Zealand is prepared, subject to the undermentioned conditions, to give rewards to the amount of £4,000, for the discovery of efficient means for rendering the flax, and other fibrous plants of New Zealand, available as articles of export, viz.:—

£2,000

To the person who shall, by some process of his own invention, first produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, one hundred tons of merchandize.

£1,000

To any person, other than the person entitled to the first reward, who shall, by some process of his own invention, next produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, one hundred tons of merchandise.

£1,000:

Viz.:—£200 to each of the first five persons, other than those entitled to the first and second rewards, who shall by any process, whether of his own invention or not, produce from the *Phormium Tenax*, or other fibrous plant indigenous to New Zealand, twenty-five tons of merchandise.

The merchandise must be saleable as an article of export from the colony of New Zealand, and have been produced at a cost not exceeding 75 per cent. of its value at the port of entry from which it is exported; and the process must be fully made known with a view to the discovery being at once made available to the public.

His Excellency the Governor of New Zealand will from time to time appoint commissions, to consist of not less than three persons, to act at such places as circumstances may require, and each claim for reward will be referred to such Commission as may be considered the most convenient for its proper investigation. The acts of the majority will be deemed the acts of the Commission.

Each Commission shall be at liberty to adopt such means as it may deem most fit for determining the value and cost of production of the merchandise, for ascertaining the process employed, and for fully investigating in all respects and reporting upon the validity of any claim.

Every claim for reward must be preferred in writing before the 1st January, 1861, to the principal officer of customs, at the port of entry nearest to the place where it is desired that the examination of the merchandise shall take place, who will at once proceed to ascertain whether the full quantity in respect of which the reward is claimed is ready for examination, and if such quantity is ready, he will give a certificate to that effect, dated on the day on which he shall have ascertained the fact, and such day shall be deemed to be the day on which the merchandise was produced.

Whenever any officer of customs is required to go more than three miles from his residence, his travelling expenses must be paid beforehand by the person requiring his attendance, and he cannot be required to attend a second time if the quantity was found deficient on the first occasion.

One half of any reward will be paid at once to any person whom a commission shall report and the Governor shall have determined to be entitled to the same—after which no other claim to the same reward will be entertained—and the other half upon satisfactory proof being given to the Governor of the *bona fide* sale of the merchandise in Europe, at an advance of not less than 20 per cent. upon the *bona fide* actual cost of the article landed in Europe.

By his Excellency's command,
HENRY JOHN TANCRED.

Home Correspondence.

ELECTRO-DEPOSITS ON ENGRAVED COPPER-PLATES.

SIR,—It was not my intention to have again reverted to the subject of electro-plating engraved copper-plates, more especially in answer to the correspondence of Mr. George T. Doo, of Great Stanmore, and M. F. Joubert, of Porchester-terrace, which appeared in the *Journal* of the 4th of March last. Certain experiments, however, which I have conducted induce me to address you again upon the subject.

Mr. Doo, in reply to my statement that " It is a tolerably well-known fact amongst those conversant with electro-metallurgy as applied to printing purposes, that engraved copper-plates have since many years been coated with silver and gold, for the purpose of protecting the plates from wear while being printed," observes, " Will Mr. Bradbury state any instances for the information of those who, like myself, are unacquainted with the fact?"

In 1852 and 1853, I had the privilege of intimately studying for a period of nearly twelve months the operations of printing in all its practical and scientific bearings, in the Imperial Printing Office at Vienna, where every new application or discovery, if not practised, had been already well-known. On my return from Vienna I made a practical acquaintance with the operations of the most famous private continental printing establishments, such as Prague, Berlin, Frankfort, Brunswick, Leipsig, and Paris, and found it was well-known that copper had been applied to the surface of stereotype plates, that gold and silver had been used to protect engraved copper-plates, and that platinum had been tried but had failed from a want of knowledge how to throw down a deposit in a bright state—at the present time possible, but still even now difficult to effect. During 1853-1856 I frequently printed from engraved copper plates covered with gold and silver, and moreover discovered special solutions for the purpose,—such as I have never seen described in any published work, and which I have found to possess durability greater than I have been able to produce from any other silver or gold solution.

The following extract from my printed Lecture " On the Security and Manufacture of Bank Notes," delivered in May, 1856, at the Royal Institution, will furnish some evidence that the subject of hardening engraved copper plates was not new to me.

" Since the discovery of the Electrotype, efforts have been made to apply its perpetuating power to the reproduction of copper engravings generally, with no other result than failure. The average number of impressions from one plate rarely reached 500. Little attention had been paid to the science of electro-deposition; failure arose from want of confidence in its power, and want of energy in its investigation. At the present time, partly owing to the perfection at which the process of electro-deposition has arrived, and partly owing to an additional new agency brought into co-operation, I can state that an experiment was recently made, to establish in this country (for it has long been in successful operation at Vienna) its practical adaptability. The experiment was made upon the Bank Notes of the National Bank of Brazil: 1,200,000 notes of high class work, were printed from Electrotype plates; the last note printed was identical with the first. The electro-plates, partly I say, owing to the increased hardness in the copper deposited, and partly owing to a particular method of treatment—the additional new agency—yielded on an average 1600 perfect impressions—and experiments are in course of operation for increasing this to between 3000 and 4000."

M. Joubert, in his letter of the date of the 1st of March, states that in reference to gold and silver having been used, " This is contrary to facts, and all the printers with whom I have acquaintance, after being consulted, will bear testimony that Mr. Bradbury is in a complete error; that there was a great desideratum for some means of protecting engraved copper-plates from wearing away as they do while at printing, and that the principal houses in London, Messrs. Macqueen, Messrs. Brookes, and others hailed with great satisfaction the introduction of my process." M. Joubert admitted to me at a personal interview, that he had travelled, but subsequently to me, over the same ground in Germany for similar purposes as myself. M. Joubert had the same opportunities of learning, with the difference that I had applied myself to study practically, while he had done so but superficially. It does not then follow, because he could not arrive at learning certain well-known facts, that I could not have done so. On our comparing notes together, M. Joubert was somewhat disconcerted at finding that I knew considerably more of the chemical and scientific applications of printing than himself. In fact, he was not prepared for finding me so generally acquainted with the scientific operations of our *confrères* on the Continent.

However, I withheld nothing from M. Joubert. I addressed myself unreservedly to him, wishing to serve him if possible; indeed I went so far as to state that I did not consider his patent as likely to be a valid one, and advised him in a friendly way to go to his agent, Mr. Carpmael, to communicate the same to him, with a view of his taking extra steps for preventing invalidity arising from any imperfection in drawing up the specification. I made no secret of my feeling on the point, and I agreed to negotiate, on the assumption that the patent was good. M. Joubert would not consent, previously to my agreeing to the terms of negotiation, to my seeing the specifications of his patent.

This appeared very strange to me, because it showed great distrust on his part while he was negotiating for what was *tantamount* to a partnership, and especially as within a week from that time his specification in the ordinary course would have been and was published.

Naturally there was an end to all negotiation.

M. Joubert then again remarks, "That other metals besides gold, silver, iron, and zinc, should be capable also of yielding deposits in a manner so as to render them useful for printing purposes, is nothing new to me, and it is of course open to any one to try them." The truth of this statement is so obvious that comment is unnecessary. M. Joubert has a perfect right to practice and enjoy any benefit arising from the use of his iron deposit, but M. Joubert should allow those who prefer to use other electro-deposits to do so without molestation or misstatement.

"As to cost," says M. Joubert, "the notion, as advanced by Mr. Bradbury, of being able to deposit palladium at two pence and platinum at one penny per square inch is simply an hallucination worthy of the assertion by the same person, of being able to print off 2,000 good impressions from a zinc deposit; besides the extreme difficulty of removing the coat of platina from the surface of an engraved copper-plate would be a serious bar to using that metal with any degree of safety."

M. Joubert, it would appear, is fond of long and high-sounding words. I again repeat, that 2,000 impressions may be obtained from an electro-zinc facing if the deposit be made with care from a combined solution of chloride and cyanide of zinc. I have done it; others, therefore, who will bestow the requisite care, may do the same. I have never compared the merits of the iron process with those of zinc. I have left M. Joubert to do that. Practically speaking, 2,000 impressions from a zinc deposit, are as good as 5,000 from an iron deposit, especially if the same means for recoating apply to the one as to the other.

Mr. Joubert strongly doubts—(nay more, he accuses me of speaking under a state of hallucination)—my being able to deposit palladium at two-pence, and platinum at one penny per square inch. I am not surprised. Did M. Joubert practically understand electro deposition, he could not do otherwise than acquiesce in my statement. What I state is an absolute fact. M. Joubert, however, knows or ought to know, that iron and zinc can be deposited at a cost of one farthing per square inch; whereas he is charging (I am speaking from personal knowledge) at rates varying from twopence to sixpence per square inch. No wonder M. Joubert is so tenacious of his process.

M. Joubert again advances as one great result of his iron process, the extreme facility it affords for removing the coating of iron when showing signs of wear, for the purpose of allowing of its renewal. On this point there is a new light:—experiments with pure nickel deposits—obtained from using a positive pole of pure nickel (difficult to obtain), show results of a new and very important character,—results which produce advantages beyond those to be obtained from iron deposits, not in point of the number of impressions each deposit will yield (and nickel will yield 5,000 impressions and upwards); because pure nickel, being a noble metal, is not oxidized by air, and even stands the weaker acids; and because, moreover, from the extreme fineness of the texture of the metal so deposited, it is not necessary to remove the coating when showing signs of wear, for the purpose of receiving a fresh deposit. Nickel gives a surface kinder, for printing purposes, than either steel, copper, or any of the known metals; the reason being simply that in addition to hardness, it possesses the smoothest, firmest, and brightest surface to be obtained from electro deposition. An engraved copper plate may be covered and recovered *ad infinitum*, thereby preserving the integrity of the original work to an illimitable number of impressions.

Again, if coloured inks made from metals be used, such inks do not in the least degree act upon nickel as they are known to do upon steel and copper. Nickel may be deposited at the same nominal cost as platinum and palladium, viz., from a penny to two pence per square inch.

The purity and the extreme fineness of nickel deposit—its non-oxidation—the facility of throwing it down—its yielding 5000 impressions and upwards from one coating—place the electro-nickel facing immeasurably above electro-iron facing as it has hitherto been done. Number of impressions alone does not constitute the sole merit in this particular application of electro-facing. Electro-iron facing hitherto has varied from 1000 to 9000 impressions, according to M. Joubert's own statement, whereas with proper manipulation there ought not to be any variation.

M. Joubert would oblige many inquiring minds by his stating upon what principle he entitles electro-iron facing —*acierage.*

I am, &c.,
HENRY BRADBURY.

Whitefriars, July 9th, 1859.

[This letter has appeared in the *Daily News.*]

Sir,—As Mr. Henry Bradbury, in a letter which has appeared in the *Daily News*, has thought fit to reopen the discussion upon the merit of my process, which I had thought closed, I trust you will in fairness insert these few lines in answer.

I pass over all the personal matter—with that the public can have no interest—and they can easily judge where good taste indicates a limit in a public discussion —but as it is important to avoid any one being misled by erroneous statements, I shall simply answer two or three of Mr. Bradbury's startling assertions, and this on scientific grounds.

1st. Is it correct to say:—"Practically speaking, 2,000 impressions from a zinc deposit are as good as 5,000 from iron deposit, especially if the same means for re-coating apply to the one as to the other?"

Now, suppose Mr. Bradbury receiving another order for 1,200,000 impressions, like the one he alludes to in his letter, and see the result. He would require to have 600 coatings, whereas, through my process, as acknowledged by Mr. Bradbury himself, 225 coatings at most would only be required. Is Mr. Bradbury prepared to maintain that, in point of expense, labour, and saving of time, the result would be the same in both cases?

2nd. As to nickel deposit, the idea very early suggested itself to me, but then the expense on the one hand —considering the cost of pure nickel—and the liability to accidents in removing the worn coating from the plates deterred me from following it up. Mr. Bradbury thinks he has hit upon turning the difficulty by suggesting that the new coating might be deposited over the worn-out one, thereby showing a total want of practical knowledge of the matter; for the result of such a process would be to add an extra thickness of metal on the portions of the plate where the coating was still subsisting, whilst on the worn portions there would only be the fresh coating just deposited, thereby destroying the harmony previously existing in the plate.

This notion displays a great want of artistic knowledge; and on a recent occasion, where I acieraged a large engraved copper-plate, for which nearly four thousand pounds had been paid, it would have been a most dangerous experiment to try the use of nickel.

Mr. Bradbury has only resorted to zinc deposition since I disclosed my process to him last summer, and he might have endeavoured to bring it forward without attempting to depreciate my mode of operating; if he can do as well, and at a more moderate charge than myself, at the same time offering to the public the same security that I do from my professional experience, he need not fear to see the tide of business running all on my side.

I remain, &c., F. JOUBERT.

Porchester-terrace, July 12, 1859.

LOCAL BOARDS AND THE YORKSHIRE UNION.

Sir,—As a Yorkshireman, I regret that our Sheffield representative did not repudiate the reflection cast upon the local examiners, by Mr. Barnett Blake, of the Yorkshire Union.

This gentleman, in the course of his remarks at the Conference, said, "What security had the candidates of one Local Board, that the Examinations of another Local Board, perhaps in the same town, had been conducted with perfect fairness?" Our immortal Bard says, "suspicion ever haunts the guilty mind;" but I hope the opinion of Mr. Blake is better than his expression of it. The Local Boards on the whole have given great satisfaction, and it is questionable whether Mr. Blake's resolution would have been an improvement. From the silence of the Yorkshire delegates, persons unacquainted with the matter would suppose that the towns in Yorkshire were difficult to manage and hard to please. Well might the Rev. Canon Girdlestone imagine, "that it was in Yorkshire alone where these explosive elements were alleged to exist."

I quite concur in Mr. Chester's opinion, that the last annual report of the Yorkshire Union did not place the Society of Arts' Examinations in a favourable light. In fact, some parts of that report appear to me to be quite antagonistic to the Society's Examinations. For instance, the following:—"Your committee regret to have to report that the success of the Examinations held by the Society of Arts has not been such as could be desired. The plan has, moreover, suffered from the want of due publicity indispensable to success, the absence of systematic organisation of Local Boards of Examiners, and the shutting out of all candidates from Institutions which did not contribute to the Society of Arts. * * * This is by no means satisfactory, and the opinion is gaining ground that a remedy will only be found in a county organisation, or the aid of some responsible body more willing than the Society of Arts to make the examinations a practical fact."

It is, however, a "practical fact," that the Yorkshire Union, with its 24,400 members, does not contain all the intellect in the county, because Leeds, Halifax, Bradford, and Sheffield, have competed and have reason to be satisfied with the result.

The fable says, when the fox could not obtain the grapes, he declared they were sour, and I suppose our Yorkshire Union friends, by a parity of reasoning, suppose the certificates of the Society of Arts are worthless. The "practical fact" that Yorkshire obtained one-third of the prizes (and this without much assistance from the institutions represented by Mr. Blake), speaks well for the intellect, as well as for the ability of the various Local Boards in the county. I believe that the sentiments of every Sheffield competitor are favourable to the ability as well as to the honourable conduct of our local examiners.

Whatever difficulty some places have had in selecting gentlemen to discharge these onerous duties, it is not because it is difficult to please a Yorkshireman, but more probably from some gentleman being determined to "ride the first horse" or else not ride at all.

Our Local Board, under the presidency of our respected vicar (Canon Sale), worked harmoniously together, were attentive to their duties, saw that our papers were worked out in accordance with the recommendations of the Council of the Society of Arts, and in the absence of positive evidence to the contrary, I shall continue to believe that the Local Boards thioughout the United Kingdom gave general satisfaction. As an individual, I do not object to the Yorkshire Union founding a "county organisation, or the aid of some responsible body more willing than the Society of Arts to make the examinations a practical fact," but the honour of establishing examinations belongs to the Society of Arts, and if the students belonging to the Yorkshire Union shrink from the contest, I fear that they are not up to the required standard.—I am, &c., A SHEFFIELD WHITTLE.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Delivered on 13*th*, 16*th*, *and* 17*th June*, 1859.

Par. No.
28. Mercantile Marine Fund—Account.
31. West India Colonies and Mauritius—Papers, Part 1.
17. Seamen's Savings Banks—Account.
19. Metropolis Turnpike Roads—33rd Report of Commissioners.
24. Cambridge University—Copy of a Statute.
3. Bills—Church Rates Abolition.
1. ,, Endowed Schools.
4. ,, Edinburgh, &c. Annuity Tax (Scotland).
5. ,, High Sheriffs Expenses.
6. ,, Newspapers, &c.
7. ,, Criminal Justice, Middlesex (Assistant Judge).
8. ,, Fishing Vessels passing the Nore.
9. ,, Galway Harbour and Port Act (1853) Amendment.
10. ,, Adulteration of Food, &c.
11. ,, Belfast Borough.
12. ,, Constabulary Force (Ireland).

First Session, 1859.

251. Population, Inhabited Houses, &c.—Return.
230. Postal Communication with North America—Mail Servic (Galway and America)—Return.
231. Railway Acts—Return.
68 (3). Trade and Navigation Accounts (31 March, 1859)—(Corrected Pages).

Delivered on 18, 20, *and* 21 *June*, 1859.

8. Sugar, &c.—Return.
9. Foreign Sugar—Account.
11. Copper, &c.—Return.
7. Church Rates, &c.—Return.
12. Fire Insurance—Return.
16. Public Works (Ireland)—Account.
32. Administration of Justice (East India and Ceylon)—Return.
34. Committee of Selection—1st Report.
35. Railway and Canal Bills—Report from General Committee.
6. Direct Taxation—Return.
23. Population, &c. (Scotland)—Return.
25. Shipping—Returns.
33. Thames Conservancy—General Report.
Italy—Further correspondence respecting the affairs of.

First Session, 1859.

221. Gas (Metropolis)—Report from Committee.

Delivered on 22nd June, 1859.

29. Court of Chancery—Return.
36. British Museum—Account and Estimate.
37. Ecclesiastical Revenues (Durham)—Return.
Decimal Coinage—Final Report of the Commissioners.
Lake Superior and the Red River Settlement—Papers.

Delivered on 24, 25, 27, 28, 29, *and* 30 *June*, 1859.

4. East India (Courts Martial)—Return.
41. General Committee of Elections—Mr. Speaker's Warrant.
10. Coinage—Accounts.
42. Trade and Navigation—Accounts (31 May, 1859).
30. Finance Accounts—Classes 1—8.
15. Bill—Appeal in Criminal Cases.

First Session, 1859.

254. National Education (Ireland)—Papers.
244. Pilotage—Abstract of Returns.

Delivered on 1st July, 1859.

39. Hops, &c.—Returns.

Delivered on 2nd and 4th July, 1859.

38. India and China (Exports and Imports)—Returns.
43. Railway and Canal Bills—2nd Report from General Committee.
44. Committee of Selection—2nd Report.
26. Steam Vessels—Return.
46. Italy—Return.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July* 15*th*, 1859.]

Dated 9*th June*, 1859.

1402. W. Bumess, 2, Prospect-terrace, Brixton, Surrey—Imp. in steam culture machinery, part of which is applicable to steam cartage and other purposes.

Dated 16*th June*, 1859.

1450. T. W. Jones, 35, George-street, Hanover-square, Middlesex—Stereoscopic glasses for single pictures.

Dated 18*th June*, 1859.

1472. J. Firth, Heckmondwike, near Leeds, and J. Crabtree, Mill Bridge, Leeds—Imp. in the manufacture of carpets.

Dated 21*st June*, 1859.

1494. L. D. Owen, 192, Tottenham Court-road—Imp. in machinery for manufacturing bolts and nails. (A com.)

Dated 27*th June*, 1859.

1532. R. Dick, Toronto, Canada—Keeping accounts current in printed form, for addressing cards, circulars, papers, and periodicals of all kinds, with great rapidity, by the aid of a very simple machine, which is a constituent part of this invention.

Dated 28*th June*, 1859.

1539. W. E. Newton, 66, Chancery-lane—An imp. in variable cut off gear for producing expansion in steam and other motive engines. (A com.)
1541. J. M. J. Baillie, 15, St. Mary Axe, London—A new process for tanning hides and skins. (A com.)

Dated 29th June, 1859.

1542. J. Nash, Mill Wall, Middlesex—An improved disengaging block.
1543. G. Hall, Junr., Montrose—Imp. in reaping machines.
1544. A. McDougall, Manchester—Imp. in the preparation of disinfecting and antiseptic substances.
1547. W. Wilkinson, Bayswater, and D. White, High Holborn—Imp. in apparatuses for holding, regulating, compressing, and burning gas and other gaseous fluids, parts of which apply to the holding of liquids.
1548. I. Tirebuck, Windsor-court, London—Improved machinery for printing from engraved plates.
1549. W. J. T. Williamson, 37, Gerrard-street, Soho—Imp. in gas burners.
1550. G. Chapman, Rutland street, Leicester—Imp. in knitting machines.
1551. J. J. Griffin, 119 and 120, Bunhill-row—Imp. in gas furnaces suitable for fusing refractory metals.
1552. G. Baker, Birmingham—Imp. in the manufacture of metallic lattice or trellis work. (A com.)

Dated 30th June, 1859.

1553. E. Francis, Wrexham, Denbighshire—Apparatus for facilitating the making up or packing of sugar, and other articles of grocery, and other substances.
1555. R. Kay, J. Manock, J. Whittaker, and T. Booth, Heywood, Lancashire—Imp. in machinery for slubbing, roving, spinning, and doubling cotton, and other fibrous materials.
1556. W. Bestwick, Salford, near Manchester—Imp. in crinoline steel for ladies' dresses, skirts, and other similar purposes.
1557. R. A. Brooman, 166, Fleet-street—Imp. in lithographic and chromo-lithographic presses. (A com.)
1558. L. Boigeol, Giromagny, near Belfors, France—Improved machinery for winding and twisting fibrous materials.
1559. T. Bell, Plaistow, Essex—Imp. in the manufacture of manure.
1562. J. A. Wilkinson, Brooklyn, U.S.—Imp. in printing presses and apparatus connected therewith.
1563. W. Summerscales, senr., and J. Summerscales, Keighley, Yorkshire—Improved wringing and mangling machine.
1564. J. Bernard, Albany, Piccadilly—Imp. in uniting certain parts of boots and shoes, and in the means employed therein.

Dated 1st July, 1859.

1565. J. R. Beard, Manchester—Imp. in the manufacture of artificial whalebone, applicable to umbrellas, parasols, hats, stays, bonnets, reeds, crinolines, and other similar purposes.
1566. A. Jones, Blackburn, Lancashire—Imp. in machinery or apparatus for drawing-in, twisting, or looming textile materials.
1567. B. Standen, Salford—Imp. in the deodorizing and separation of fœcal and putrescent organic matters, in the preparation or manufacture therefrom of a portable artificial manure or fertilising compound, and in apparatus to be employed in such preparation or manufacture.
1568. A. Carron, 25, Little Moorfields, London—An improved loom for the manufacture of silk and other velvet. (A com.)
1569. N. Ardaseer, Bombay, East Indies—An improved method of making steam boilers.
1570. J. B. Howell, Sheffield—Imp. in the treatment of iron.
1571. E. W. Carter, Rochdale—Imp. in machinery or apparatus for sewing.
1572. E. A. Wood, Victoria-terrace, Notting-hill, and M. D. Rogers, Bromley, Middlesex—Improved apparatus for raising and lowering boats.
1573. S. Fisher, Birmingham—Imp. in ordnance and projectiles.
1574. R. Royds and A. Harcourt, Woolston, Hants—An improved composition for protecting the bottoms of ships and other structures of iron.
1575. W. Riddle, Westbourne-terrace, Barnsbury-park, Islington—Imp. in advertisement show cards or boards.
1576. W. E. Kenworthy, Water-lane, Leeds—Imp. in purifying gas, and saving of lime in the said purifying.
1577. M. Bogg, Duggleby, near Malton, Yorkshire—Imp. in washing machines.

Dated 2nd July, 1859.

1578. C. H. P. Cook, Glasgow—Imp. in ventilators and ventilating flue or chimney tops.
1579. R. W. Morville, Pendleton, Salford—Imp. in mechanism, or arrangements for suspending and securing window sashes. A com.
1580. T. J. Hart, Birmingham—Imp. in breach loading fire-arms.
1581. C. G. Guy, Liverpool, J. Brough, and R. Cotton—An improved upright steam boiler.
1582. E. Fourmaux, junior, Provin—A new weaving loom.
1583. C. H. G. Williams, 32, Regent-square, Gray's-inn-road—Imp. in dyeing fabrics and yarns.
1584. H. Hirsch, Berlin, Prussia—Imp. in screw propellors.
1585. H. Harris, Newport, Isle of Wight—An improved method of connecting together the parts of which bedsteads and other furniture are composed.

Dated 4th July, 1859.

1586. J. Simon, Paris, Passage des Petites Ecuries, No. 5—A composition named zeiodelite, a kind of paste which becomes as hard as stone, is unchangeable by the air, and being proof against the action of acids, may replace lead and other substances for various uses.
1587. J. Hollingworth, Clyde Paper Mills, Eastfield—Imp. in machinery or apparatus for the manufacture of paper.
1588. R. Lane, Cirencester—Imp. in mills for grinding grain and other materials.
1590. R. A. Brooman, 166, Fleet-street—An improved hemmer or apparatus, to be used in connection with sewing machines, for turning over and presenting the edge of the material to be hemmed properly to the needle. A com.
1591. R. A. Brooman, 166, Fleet-street—A cementing powder or mixture, and process for cementing, converting, refining, strengthening, and steelifying iron. A com.
1592. A. V. Newton, 66, Chancery-lane—An imp. in the process of, and improved apparatus for, separating metals from their ores. A com.

Dated 5th July, 1859.

1593. J. McIntosh, Glasgow—Imp. in the manufacture of leather driving belts.
1594. W. Knapton, of Albion Foundry, Monkbar, and A. Aitchison, Knottingley, Yorkshire—Imp. in the manufacture of gas.
1597. W. E. Newton, 66, Chancery-lane—Improved apparatus for moving iron and other metals while the same is in process of manufacture at the rolls. A com.
1599. J. Watkins, Cwmamman Colliery, Aberdare, Glamorganshire, and J. Pugh—Imp. in lubricating wheels.

Dated July 6th, 1859.

1601. J. Luis, 1B, Welbeck street, Cavendish-square—An apparatus for washing wool, manufactured or not, and all other matters. A com.
1603. J. Horton, Dudley—A new or improved gas meter.
1605. S. B. Haskard, Wollaton-street, Nottingham—Imp. in the manufacture of hook guides used in machines for the making of lace or other fabrics.
1607. L. Schwartzkopff, Berlin, and F. C. Philippson, Dusseldorf—Imp. in steam hammers, and in machines for cutting files, and for planing and grooving iron, stone and other substances.
1609. J. T. Edmonds, Prestwood, Great Missenden, Bucks—Imps. in winnowing or corn-cleaning machines, parts of which are applicable for other screening or sifting purposes.

Dated 7th July, 1859.

1613. J. Knowelden, Southwark, Surrey, and D. E. Edwards, Upper Belgrave-place, Middlesex—Imp. in hydraulic engines and pumps, and the employment of apparatus for applying motive power.
1615. Sir F. C. Knowles, Bart., Lovell-hill, Berks—Imp. in making iron castings.
1617. W. Robinson, Wembdon, Bridgewater, Somerset—Imp. in cask washing machines.

Invention with complete Specification Filed.

1621. W. Waite, York-house, No. 48, Baker-street, Portman-square—Manufacturing bonnets, hats, and other articles, partly or entirely from the leaves of the palm tree, or other flat or thin material.—8th July, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, July 15th*, 1859.]

July 13th.

120. J. Barrans.

July 15th.

128. Joseph Eccles.
143. R. G. Salter.
144. G. Collier and J. Collier.
149. G. Hamilton.
151. C. D. Archibald.
152. R. A. Brooman.
156. W. Trotter.
160. P. A. Sparre.
162. E. T. Hughes.
164. E. Stevens.
166. W. Poupard.
171. H. Hilliard and T. Chapman.
172. A. Lindo.
176. S. Phillips.
189. R. Howell and R. J. Willder.
245. T. Hartshorne.
252. G. F. Bradbury and J. J. King.
256. W. Robertson.
301. S. Tearne.
336. T. R. Ayerst.
496. S. Russell.
511. T. C. Hinde and G. J. Hinde.
556. W. E. Newton.
986. C. Batty.
1004. J. Davies.
1002. G. Roberts and J. Bridges.
1043. H. Ailman.
1160. F. N. Hadlow.
1167. W. F. Nuthall.

[*From Gazette, July 19th*, 1859.]

July 19th.

161. T. Clarke.
163. J. Whitehead.
179. J. Bent.
185. L. Le Prince.
194. J. H. Hume.
197. J. Newman.
206. T. W. Rammell.
208. R. Barter.
216. J. Fowler, R. Burton, D. Greig, and J. Head.
276. J. Robertson.
281. L. Rigolier.
328. J. Honeyman.
432. A. V. Newton.
926. R. Coleman.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, July 15th*, 1859.]

July 13th.

1660. W. Clibran and J. Clibran.
1670. H. Turner.
1767. W. Wood.

[*From Gazette, July 19th*, 1859.]

July 14th.

1683. J. Cartwright.

July 15th.

1684. Rev. G. Jacque.
1701. J. L. Crockett.
1705. J. L. Crockett.

July 16th.

1674. T. Duncan.
1758. G. Collier, J. Crossley, and J. W. Crossley.

Journal of the Society of Arts.

FRIDAY, JULY 29, 1859.

BRITISH ASSOCIATION MEETING.

The meeting of the British Association for the Advancement of Science is fixed for the 14th of September, at Aberdeen. H.R.H. the Prince Consort will preside, and deliver the opening address.

OPENING OF GALLERIES OF ART IN THE EVENING.

The following report of the Commission appointed to consider the subject of lighting picture galleries by gas has been recently presented to the House of Commons:—

The Commission, consisting of Professors Faraday, Hofmann, and Tyndall, Mr. R. Redgrave, R.A., and Captain Fowke, R.E., appointed for the purpose of reporting to the Lords of the Committee of Privy Council on Education on the lighting of picture galleries by gas, and on any precautions (if necessary) against the escape of gas, and the products of its combustion,—having met at various times and considered the subject referred to them, now make the following report:—

There is nothing innate in coal gas which renders its application to the illumination of picture galleries objectionable. Its light, though not so white as that of the sun, is equally harmless; its radiant heat may be rendered innocuous by placing a sufficient distance between the gas jets and the pictures, while the heat of combustion may be rendered eminently serviceable in promoting ventilation.

Coal gas may be freed from sulphuretted hydrogen compounds, and in London is so at the present time; it then has little or no direct action on pictures. But it has not as yet been cleansed from sulphide of carbon, which, on combustion, yields sulphurous acid gas, capable of producing 22½ grains of sulphuric acid per 100 cubic feet of present London coal gas. [Hofmann.] It is not safe to permit this product of the combustion to come in contact with pictures, painted either in oil or water colours; and the Commission are emphatically of opinion that in every system of permanent gas lighting for picture or sculpture galleries, provision should be made for the effectual exclusion or withdrawal of the products of combustion from the chambers containing the works of art.

The Commission have examined the Sheepshanks' Gallery as an experimental attempt to light pictures with gas, and are of opinion that the process there carried out fulfils the condition of effectually illuminating the pictures and at the same time removing the products of combustion. According to the indications of the thermometer required and obtained, it does this in harmony with, and in aid of, the ventilation, and does not make a difference of more than one degree Fahrenheit at the parts where the pictures are placed, between the temperatures, before and after the gas is lighted.

Certain colour-tests, consisting of surfaces covered with white lead, or with vegetable and mineral colours (especially the more fugitive ones), and in which also boiled linseed oil, magylp, and copal varnish were employed as vehicles, had been prepared, and were, when dry, covered one-fourth with mastic varnish, one-fourth with glass, one fourth with both mastic varnish and glass, and one fourth left uncovered. Sixteen of these have been placed for nearly two years in different situations, in some of which gas has been used, in others not. They give no indications respecting the action of coal gas (except injury from heat in one placed purposely very near to and above the gas-burners), but seven of them show signs of chymical change in the whites, due to either a town atmosphere or want of ventilation. The most injured is that from the National Gallery, Charing-cross, and the next is from a country privy; the third, much less changed, is from the House of Commons; the fourth is from the Barber Surgeons'-hall; the fifth from the Bridgewater Gallery; the sixth from the Royal Society's rooms at Burlington-house; the seventh from the British Museum.

The remaining tests, hung in—1. Sheepshanks' Gallery, South Kensington; 2. Secretary's room at South Kensington, where no gas is used; 3. Mr. Henry Drummond's drawing-room at Albury-park, Surrey; 4. Sealed up and kept in a closet in the secretary's room at South Kensington; 5. Lambeth Palace, vestibule of the staircase; 6. British Institution, picture gallery; 7. Windsor Castle, room with a north aspect without gas; 8. Mr. Thomas Baring's picture gallery, 41, Upper Grosvenor-street, frequently lit with gas; present no observable change in this respect.

Though apart from the especial subject submitted to the Commission, the members cannot resist a recommendation that this kind of trial, which is especially a painter's experiment, should be continued for a longer period, and, indeed, be carried out on a more extensive scale.

The Commission think it right to state that they were unanimous on all the points to which their attention had been called, or which are referred to in this report.

M. FARADAY,
A. W. HOFMANN,
JOHN TYNDALL,
RICHD. REDGRAVE,
FRANCIS FOWKE, Captain, R.E.

South Kensington, July 20.

HISTORICAL ACCOUNT OF THE INTRODUCTION OF THE GALVANIC AND ELECTRO-MAGNETIC TELEGRAPH.

By Dr. Hamel, Member of the Imperial Academy of Sciences at St. Petersburg.

(Concluded from page 599.)

I have been endeavouring to find out from the papers of Soemmerring, whether he and Baron Schilling might have had a knowledge of the Italian Giandomenico Romagnosi's important discovery, made many years ago, that the magnetic needle deviates from its normal direction when under the influence of the galvanic current, and of which he had published an account in a newspaper, at Trent, on the 3rd of August, 1802. It began thus: "Il signore Consigliere Giandomenico Romagnosi si affretta a communicare ai Fisici dell' Europa uno sperimento relativo al fluido galvanico applicato al magnetismo."

I found that Baron Schilling, immediately after his return to Munich, in 1815, communicated to Soemmerring the little book "Manuel du Galvanisme," by Joseph Izarn, Professor of Natural Philosophy at the Lycée Bonaparte, which was printed in Paris in 1805, and in which, on page 120, in § ix., mention is made of Romagnosi's discovery. I have also seen a note from Soemmerring, mentioning that he had read this treatise with attention. I came, however, to the conclusion that neither to Soemmerring, nor to Baron Schilling, had any idea of a practical application of Romagnosi's observation presented itself, particularly as no rapid motion of the needle had been pointed out.

In the autumn of 1820, Soemmerring had decided to leave Munich for good, and to reside the rest of his life in his favourite place, Frankfort; he went there on the 13th October.

Letters show that the cordial friendship between him and Baron Schilling continued unchanged to the time of his decease, in 1830.

It is well known that in 1820 a new era for the art of telegraphing was dawning. Hans Christian Oersted, at Copenhagen, had directed the attention of the scientific world much more effectually than Romagnosi, in Italy, had done, to the fact that the magnetic needle deflects, when a galvanic current comes near it.

Arago, of the Academy of Sciences in Paris, received the information about Oersted's doings at the same time, and from the same source as myself.

It was in August, 1820, at Geneva, when I was making preparations for my second ascent of Mont Blanc, in order to follow out observations on the effects of the rare air at great heights on muscular motion, when Professor August Pictet, with whom I was then in daily intercourse, received Oersted's circular announcement in Latin: "Experimenta circa effectum conflictus electrici in acum magneticam," dated Copenhagen, July 21st. Just then Arago had come to Geneva, being on his way to Paris, where he intended to observe the solar eclipse on the 7th September.

At Pictet's request, Professor de la Rive repeated Oersted's experiment many times, as well with a powerful battery of 380 pairs of plates six inches square, as with a small one, made by Selligue, of twelve copper cups with a zinc plate in each. It happened that on the 19th of August, when De la Rive was experimenting with the said large battery, to show Arago and some scientific persons of Geneva the brilliant incandescence of charcoal-points when placed in the voltaic circuit, in the open air, and also in a vacuum, I was, much against my wish, detained on Mont Blanc, at the Grands Mulets, the whole day, as well as the preceding and following night, in clouds discharging flashes of lightning.

I cannot forego stating my belief that Oersted knew of Romagnosi's discovery, announced in 1802, which was eighteen years before the publication of his own observations. It was mentioned in Giovanni Aldini's (the nephew of Galvani's) book: "Essai théorique et expérimental sur le Galvanisme," printed at Paris in 1804, and dedicated to Bonaparte, to whom, in Italy, he had had the honour to explain experiments relating to his uncle's great discovery,* He says, at page 191: "M. Romanesi, physicien de Trente, a reconnu que le galvanisme faisait décliner l'aiguille aimantée."

Oersted was in Paris in 1802 and 1803, and it appears from the book of Aldini that Oersted, at the time he finished it, was still in communication with him, for he says at the end (page 376), he had not been able to add the information received from Oersted, Doctor of the University at Copenhagen, about the galvanic labours of scientific men in that country, nor that relating to new apparatus invented by himself. In 1813 Oersted had been again in Paris.

Who would suppose that Oersted did not know everything contained in Aldini's book, in which even the index points to Romagnosi's discovery in the following words: "Romanesi a fait des tentatives sur l'aiguille aimantée, page 191"?

In Izarn's "Manuel" of 1805, above quoted, the mention of Romagnosi's discovery is evidently taken from Aldini's book of 1804. The words there are: "D'après les observations de Romagnési, physicien de Trente, l'aiguille déjà aimantée et que l'on soumet au courant galvanique, éprouve une déclinaison." Now, this is literally what, since 1820, the world has been accustomed to call Oersted's discovery.

As Oersted must have known Romagnosi's experiment, it would have been an additional credit to him, if, in 1819 and 1820, on making known his own observations, he had just said a word about Romagnosi as pioneer in the field on which be became loaded with laurels.

In Alessandro de Giorgi's collection of the works of Romagnosi, printed at Milan, there is prefixed to the first volume a likeness of him, engraved from a painting by Ernesta Bisi. I wish somebody would copy it by photographic means, and then multiply this portrait by the same process, for distribution among the lovers of electrical science. I can, for a similar purpose, furnish the portrait of Baron Schilling.

Arago had hardly got to Paris, when, on the 4th September, he communicated to the Academy of Sciences what he had seen at Geneva. He was requested to repeat Oersted's experiment, which he did at the sitting of the Academy on the 11th. Two weeks after that Arago communicated to the Academy his observation that the galvanic conductors attracted needles that were not magnetised.

It deserves here to be remembered that, from Aldini's book, it was known that the chemist Giuseppi Mojon, at Genoa, had, before 1804, observed in unmagnetised needles, exposed to the galvanic current, a sort of polarity. Izarn repeats this also in his "Manuel du Galvanisme," which book was one of those that, by order, were to be placed in the library of every Lycée in France.

Ampère, who, as is well known, bestowed most particular attention on the subject brought, in 1820, before the scientific world through Oersted, mentioned that it might perhaps be possible to make use of the deviation of the needle for telegraphic purposes, but neither he nor any one else then constructed such an instrument.

It was reserved for Baron Schilling, at St. Petersburg, to make the first electro-magnetic telegraph. Having become, as we know, through Soemmerring, at Munich, passionately fond of the art of telegraphing by means of galvanism, he now used for it the deflection of the needle, which he placed within the multiplier of Schweigger horizontally on a light vertical axle hanging on a silken thread, and bearing a circular disc of paper, coloured differently on each side. To make the needle move steadily and prevent oscillations, Schilling had fixed to the lower extremity of its axle a strip of thin platina plate and immersed it in a cup of mercury. By degrees he simplified the apparatus. For a time he used five needles, and, at last, he was able to signalise even with one single needle and multiplier, producing by a combination of movements in the two directions all the signs for letters and numbers. Having known Soemmerring's alarum, Schilling invented one for his telegraph also. His success in bringing his instrument to a state of high perfection would have been much more rapid, had his time not been so much occupied with various duties, and particularly with the founding and directing of a large lithographic establishment for the government.

Baron Schilling's telegraph was an object of great curiosity at St. Petersburg; it was frequently exhibited by him to individuals and to parties. Already the Emperor Alexander I. had been pleased to notice it in its earlier stage, and, when it was reduced to great simplicity, his Majesty the Emperor Nicholas honoured Baron Schilling, on the 13th of March, 1830, with a visit at his lodgings in Opotchinin's house, in the Konooshennaja, to see experiments performed with it through a great length of conducting wires.

His Majesty had long before repeatedly witnessed in the summer camp, near St. Petersburg, the exploding of mines by means of Schilling's carbon igniters through conducting ropes at great distances. Once Baron Schilling had the honour to present to the Emperor, in his tent, a wire. He begged his Majesty to touch with it another wire, whilst looking through the door of the tent in the direction of a very far distant mine. A cloud of smoke with earth rose from this exploding mine at the moment the Emperor, with his hands, made the contact. This caused great sur-

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[*] Aldini wrote in his dedication to Bonaparte, who was then First Consul: "Il sera mémorable à jamais dans les fastes de l'Histoire du Galvanisme le jour où, descendu à peine en Italie, vous me permîtes d'en développer devant vous les principales expériences au milieu des vastes occupations militaires et politiques dont vous étiez environné. Le souvenir de cette époque honorable m'enhardit à vous dédier cet ouvrage."

prise, and provoked expressions of satisfaction and applause.

In May of the last-mentioned year, 1830, Baron Schilling undertook a journey to China. He had a strong propensity for studying the language, and everything relating to China. His most ardent desire was to be able to visit Pekin, but he was obliged to confine his travels to the borders of the Empire. He collected in Mongolia a great quantity of precious Chinese and Mongolian writings, which are now preserved in the Imperial Academy of Sciences in St. Petersburg. He had a small electro-magnetic telegraphical apparatus with him, and the astonishment which the experiments, performed with it, excited, assisted him not a little to obtain many of the most interesting works, which he would not have got by simply paying for them.

After his return from the borders of China to St. Petersburg in March, 1832, Baron Schilling occupied himself again with the telegraph, and in May, 1835, he undertook a journey to the West of Europe, taking his simplified instrument with him.

In the month of September he attended the meeting of the German Naturalists at Bonn, on the Rhine, where, on the 23rd, he exhibited his telegraph before the section of natural philosophy and chemistry, over which Professor Georg Wilhelm Muncke, of the University of Heidelberg, presided. Muncke, who had been ever since 1826 an honorary member of the Imperial Academy of Sciences at St. Petersburg, was much pleased with Schilling's instrument, and he determined at once to get one for exhibition at his lectures.

I have lately, at Heidelberg, in the Western Main Street (Westliche Hauptstrasse), opposite the former convent of Dominicans, in the upper story of the house under No. 52, called: Zum Riesen, where, at present, the Cabinet of Natural Philosophy is located, found in a store-room, belonging to it, the apparatus which Professor Muncke got made in imitation of the one exhibited by Baron Schilling at Bonn.

We know now, that Baron Schilling brought his electro-magnetic telegraph from St. Petersburg to Bonn, and that a similar one was made for Heidelberg. It remains to trace out how Schilling's contrivance found its way from Heidelberg to London.

It will surprise many to learn that the individual who became the cause of this being done was, when a new-born child, mentioned by Lord Byron.

In a letter which Lord Byron wrote on the 20th of February, 1818, from Venice to the publisher of his productions, Mr. John Murray, in Albemarle-street, London, he says at the end, " Mr. Hoppner, whom I saw this morning, has been made the father of a very fine boy. Mother and child are doing very well indeed.*

The father of this child, Richard Belgrave Hoppner, was one of three sons of John Hoppner, the celebrated portrait painter, who, even at the time of his birth, in 1759, had received special attention from King George III., and who died as one of the Royal Academicians on the 25th of January, 1810.†

R. B. Hoppner—whose name is known to us in Russia, because, in 1813, he translated from the German into English, our Admiral Krusenstern's " Voyage round the world in the years 1835-6"—was married in September. 1814, at Brussels, to Mademoiselle Mary Isabelle May, daughter to Beat Louis May, living in the Canton of Berne, in Switzerland. In November of the same year he was appointed Consul-General at Venice and the Austrian territories in the Adriatic.

Lord Byron, when at Venice, in 1817, became a great friend of his, as may be seen from his letters, out of which not less than eighteen are printed by Thomas Moore in his " Letters and Journals of Lord Byron." In several of them he alludes to Hoppner's, then " little, son."

On examining at Heidelberg the books in which the names of the students at the University are entered, I found that this John William (the name Rizzo is not mentioned) Hoppner became a student there in 1834. He applied himself particularly to those branches that would enable him to become a civil engineer; indeed, he was subsequently for a time employed by Mr. Robert Stephenson, on the making of the railroad from Florence to Leghorn. With his subsequent history we have here nothing to do.

During the winter of 1835-6, he was lodged at Heidelberg in Engelman's house.

I now have to speak of the gentleman who, through John William Rizzo Hoppner, was induced to transfer Baron Schilling's mode of telegraphing to England.

William Fothergill Cooke, who, as a young man, had, been six years in India in military service, had, in 1831, come to England on leave to visit his parents, and had, soon after that, left the service altogether. His father, Dr. William Cooke (who died on the 21st March, 1857), had for some time lived at Durham, and was subsequently appointed Reader in Medicine at the then lately organised University there. He began his lectures in 1833.

W. F. Cooke, wishing to make for his father anatomical models in wax to be used at his lectures, went to Paris, where he attended, during the winter of 1833-4, lectures on anatomy. In the spring of 1834 he returned to Durham, and made there such models as his father most wanted. In the summer of 1835 he accompanied his parents on a tour to Switzerland. Ascending the Rhine, Heidelberg was visited. Here Professor Tiedemann, the director of the then existing Anatomical Institute, offered to assist young Mr. Cooke in procuring the necessary means for making preparations in wax for his father, if he would come back to Heidelberg.

Accordingly, W. F. Cooke returned in the month of November from Berne, in Switzerland, to Heidelberg, where he lodged in the Plöckstrasse, in the house No. 97, at that time belonging to the brewer Wilhelm Speyrer, but now to the brewer Georg Müller. It bears the strange inscription: " Bierbrauerei zum neuen Essighaus." There had been before vinegar works in that house.

As Mr. Cooke was not permitted to make here, in the cleanly-kept apartments, anatomical dissections, he hired a room in the same street, nearly opposite, in the house of the gardener Schwartz, No. 58, now belonging to his grandson, the turner Ferdinand Koch. Here during the winter he was so active, that at the end of it he was able to send off four cases full of models in wax to his father at Durham.

In the present Anatomical Museum at Heildelberg, finished in 1848, I have, under Nos. 382, 383, and 628, found three wax models, made by Mr. Cooke during the winter mentioned. The one under No. 628 is marked W. F. C., Dunelm.

In the beginning of March 1836, Mr. Cooke heard accidentally from John William Rizzo Hoppner, with whom he had formed an intimate acquaintance, because his relations lived in the Canton Berne, where Mr. Cooke had been with his own parents, that the professor of natural philosophy had an apparatus with which he could signalize from one room to another. This was Baron Schilling's telegraph, but Mr. Hoppner did not know it.

The professor was no other than the already mentioned Geheime Hofrath Muncke. He had in the upper story of the former Convent of Dominicans, where he gave his lectures, and where he also lived, suspended wires for telegraphing out of the Cabinet into the Auditory.

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* The child being christened: John William Rizzo, Byron wrote four lines in verse, which have been printed, not only in the original English, but also metrically translated in ten other languages, which translations, with the exception of the Armenian, are to be seen in Murray's " Poetical Works of Lord Byron," p. 571.

† Another son of his, Henry Perkyns Hoppner, had accompanied Lord Amherst in 1816 to China, and is known as a navigator in the Arctic Seas with Parry and Ross. He died on the 23rd December, 1833. The third son, Lascelles drew, as a first artistic production, the frontispiece to the father's translation of " Oriental Tales," printed in 1815.

I have examined these localities; the rooms are now quite empty. When I was there the floors were used to dry hops, spread out on them. From the year 1850 to 1852, the house had served as a military barrack.

As Mr. Cooke was curious to see the telegraphing out of one room into another, Mr. Hoppner took him on the 6th of March, 1836, to Professor Muncke's lecture room.

When Mr. Cooke saw the telegraphing, and was told that the instrument could work through great distances, the idea struck him that such a thing might be useful in England, particularly in tunnels along the railroads, which were at that time spreading more and more, and he determined to give up at once his anatomical occupation at Heidelberg, get such an apparatus as the Professor used made, and go to England, to endeavour to get such telegraphs there brought into use.

Mr. Cooke, who had never occupied himself with the study either of natural philosophy in general, or of electricity in particular, did not at all get further acquainted with Professor Muncke; he did not even acquire his name properly; he calls him Möncke. He had no idea that the apparatus he had seen had been contrived by Baron Schilling in Russia. He did subsequently suppose that Professor Möncke might have had the idea from Gauss, whom he calls Gaüss.

Let us see how Mr. Cooke himself, some years afterwards, in 1841, describes what I have here, from my own investigation, detailed.

He wrote: "Having returned from India on leave of absence, on account of the state of my health, and afterwards resigned my commission, I was studying anatomy and modelling my dissections, at Heidelberg, when, in March 1836, I happened to witness one of the common applications of electricity to telegraphic experiments, which had been repeated without practical result for half a century. Perceiving that the agent employed might be made available to purposes of higher utility than the illustration of a lecture, I at once abandoned my anatomical pursuits, and applied my whole energies to the invention of a practical Electric Telegraph."

Who could, on reading this, have discovered that Mr. Cooke had seen experiments performed with a copy from the electro-magnetic telegraph made by Baron Schilling at St. Petersburg, and brought by him, six months before that time, to Bonn, the working of which is here mentioned by Mr. Cooke as "one of the common experiments repeated for half a century;" consequently, even before either electro-magnetism or a voltaic battery had been discovered?

When, in consequence of unpleasant disputes between Professor Wheatstone and Mr. Cooke, Sir Isambard Brunel and Professor Daniel were, in 1840, appointed arbitrators, they, without taking the trouble to find out what telegraph Mr. Cooke had seen, said, in their award (1841), that, "in March 1836, Mr. Cooke, while engaged at Heidelberg in scientific pursuits, witnessed, for the first time, one of those well known experiments on electricity, considered as a possible means of communicating intelligence, which have been tried and exhibited from time to time, during many years, by various philosophers."

On another occasion, Mr. Cooke intended to give the name of the person whom he saw signalizing with a telegraph, but where this telegraph came from he did not know. He wrote: "In the month of March, 1836, I was engaged at Heidelberg in the study of anatomy, in connexion with the interesting and by no means unprofitable profession of anatomical modelling, a self-taught pursuit to which I had been devoting myself with incessant and unabated ardour, working frequently fourteen or fifteen hours a day, for about eighteen months previous. About the 6th of March, 1836, a circumstance occurred which gave an entirely new bent to my thoughts. Having witnessed an electro-telegraphic experiment, exhibited about that day by Professor Möncke of Heidelberg, who had, I believe, taken his ideas from Gaüss, I was so much struck with the wonderful power of electricity, and so strongly impressed with its applicability to the practical transmission of telegraphic intelligence, that from that very day I entirely abandoned my former pursuits, and devoted myself thenceforth with equal ardour, as all who know me, can testify, to the practical realization of the Electric Telegraph, an object which has occupied my undivided energies ever since. Professor Möncke's experiment was at that time the only one upon the subject that I had seen or heard of."

Mr. Cooke states, that within three weeks after he had seen Professor Möncke's telegraph, he had got made, partly at Heidelberg (where Mr. Hoppner assisted him), and partly at Frankfort, a similar one, but with three needles, with which he could produce 26 signals.

He came to London on the 22nd of April, 1836. There he applied himself, as he says, almost night and day, to the making of his so-called mechanical instrument, worked by the attraction of an electro-magnet, which in January, 1837, he submitted to several of the leading gentlemen connected with the Liverpool and Manchester railway, proposing its adoption in the long tunnel close to Liverpool, which descends from Edgehill to the station in Lime-street, but this proposal was not followed out.

Having twice consulted Dr. Faraday, Cooke, by the advice of Dr. Roget, visited, on the 27th February, 1837, Professor Charles Wheatstone at his residence, in Conduit-street, and was soon after taken by him to his rooms in King's College.

The result of Cooke's acquaintance with Wheatstone was, that, in May, 1837, they resolved to unite their efforts in endeavouring to introduce the use of telegraphs in England.

Professor Wheatstone was at that time not yet sure whether the electro-magnet would work sufficiently well at considerable distances, and Mr. Cooke, who had left on the continent the instrument made at Heidelberg, constructed another like it with four deflecting needles. The opinion was, that the principle on which "Möncke's" instrument worked would be the best to adopt for practical use. Neither Professor Wheatstone, nor Mr. Cooke, knew that in so doing they were adopting Baron Schilling's plan.

On the 12th June a caveat for a patent was lodged, and it was determined to institute an experiment with the projected telegraphic apparatus on a line of some extent.

Accordingly, on the 25th July, a trial was made at the terminus of the London and Birmingham Railway, then constructing, along wires one mile and a quarter in length, from Euston-square to Camden Town. This was the first instance of out of door telegraphing in England with a galvanic apparatus. It took place thirteen days before the decease of Baron Schilling, who died at St. Petersburg, on the 7th of August, without getting informed of the introduction of his telegraph into England.

On the 19th of November, 1837, Messieurs Cooke and Wheatstone concluded a partnership contract, and on the 12th December they gave in the specification of their apparatus. It was not called a new invention, but an improvement. Indeed, it was in the essential part founded on the same principle as Baron Schilling's, namely the deflection of needles by multipliers. Professor Wheatstone had, as was to have been expected from such a philosopher, greatly improved the application; the needles were placed in a vertical instead of the horizontal position. At first he made an instrument with five such needles, but subsequently telegraphs with two needles, and also with one needle, were adopted along the various lines.*

Mr. Cooke's merits, in having with great zeal laboured in the practical establishment of the first telegraph lines in England, are well known.

About a fortnight before the above-mentioned first and perfectly successful trial of telegraphing by Cooke and Wheatstone in England, Steinheil, at Munich, had completed the junction of his house in the Lerchenstrasse with the building of the Academy of Sciences, and with the Royal Observatory at Bogenhausen, by means of 36,000 feet of wire for conducting the current both ways, the wires being suspended in the air. Already, in 1833, the Cabinet of Natural Philosophy, of the University at Göttingen, had been united, by Professor Wilhelm Weber, for electro-magnetic signalising, with the Astronomical Observatory, distant 3,000 feet, to which, in 1834, was added the Magnetic Observatory, situated near it.

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* It was, in 1838, erroneously stated to the Academy of Sciences in Paris, that Baron Schilling had "vertical" needles in his telegraph, and the Abbé Moigno, quoting this communication, even says that there were "five vertical" needles.—Schilling had not one vertical needle.

Baron Schilling, during the journey which he undertook, in 1835, had made, together with Baron Jacquin and Professor Andreas von Ettingshausen, at Vienna, a series of experiments, with a view to find out the comparative merits of placing the conducting wires over the roofs of houses in the air, and of laying them in the earth. The latter trials were made in the botanical garden of the University, near the Rennweg. The result was like that obtained subsequently by Steinheil, at Munich, namely, that the earth conducted the current from one wire to the other laid at some distance parallel, which was then still supposed necessary for the return of the current. Steinheil had been led to make a trial of laying the wires in the earth, because at Göttingen the wires in the air had been several times injured by strong winds. Baron Schilling, Baron Jacquin and Professor Ettingshausen, at Vienna, concluded that the suspending of the wires in the air was the better method.*

After all that had been accomplished before the month of September, 1837, in Europe by Baron Schilling, by Steinheil, by Weber and Gauss, and by Cooke and Wheatstone, it is offensive to observe that in America the painter Morse, who made, on the 4th September, 1837, a poor experiment which he considered "successful," is held out as having made an electro-magnetic telegraph before anybody in Europe.

Samuel Finley Breese Morse,† born 1791, the eldest of three sons of the late Rev. Jedediah Morse, known for his geographical publications, having a taste for painting, and wishing to study this art, had for that purpose, from 1811 to 1815, been in England (at London and Clifton). At the close of 1829 he came again to Europe, and went by London and Paris to Rome and Naples, thence back to Paris, where he remained about a year to copy paintings in the Louvre. In the autumn of 1832 he returned from Havre to America.

On board the packet ship, the Sully, there was, among other passengers, Dr. Charles T. Jackson, of Boston, who had attended in Paris, besides other lectures, those of Pouillet, at the Sorbonne. I call to mind here that Pouillet the year before, in 1831, had had made his large electro-magnet, which supported the weight of more than one thousand kilogrammes.

During the voyage, which lasted from the 8th of October to the 15th of November, Dr. Jackson repeatedly directed the conversation to the subject of electricity and electro-magnetism, which gave occasion to speak about the possibility of electro-magnetic signalising or telegraphing. Dr. Jackson had with him on board a small electro-magnet, which he had bought in Paris, at Pixii fils, and also a small galvanic battery. He pointed out some means as likely to serve for the purpose mentioned, by sketches, some of which I have seen in Dr. Jackson's pocket-book.

Arrived at New York, Morse endeavoured to gain his livelihood, as had been the case formerly, by painting portraits.

He being now always called Professor, most persons believe that he is a professor of natural philosophy, or some other branch of natural science, but this is not the case. In 1835 he got the title of "Professor of the Literature of the Arts of Design." It was supposed that he might, in the so-called University of the city of New York, where he was then lodged, lecture on that subject, but he has never, as I know from himself, given one single lecture thereon to pupils.

As his occupation in painting portraits, ever since his return in 1832, hardly produced him the means of supporting himself, he, towards the end of 1835, after Baron Schilling's exhibition of his telegraph at Bonn, took it into his head to try to arrange something for signalising by means of electro-magnetic action, of the possibility of which Dr. Jackson had informed him, but his trials remained without success, because he did not know what was wanted to make a powerful magnet. Two years later, in 1837, when news of the above described doings in Europe reached America (his brother Sidney was editor of a newspaper), he, with the aid of a scientific gentleman, who knew what Professor Henry, at Princeton, had done with regard to electro-magnets, produced something which, however, was not at all fit for practical use.

Professor Henry and Professor Bache, from America, had been, in 1837, in London, and had visited Professor Wheatstone in King's College on the 11th of April, which was six weeks after Mr. Cooke had been with him. During the summer Professor Wheatstone had signified to some Americans his wish to make an application for a patent at the Patent Office in Washington.

Morse's idea, then, was not to produce on paper letters or signs representing them, but to have only ten signs for the nine digits and the zero. With these he proposed to express numbers on strips of paper. In an alphabetical vocabulary the words were all numbered. He had an eleventh sign which served to indicate that the next following signs were really to represent numbers, not words. For each of the signs mentioned, he had a metal type with a certain number of Λ shaped projections. These types he introduced, one after the other, into a port-rule by which they were moved forward. The teeth of the types were to lift a lever, by means of which the electric current was allowed to flow through the coils of an electro-magnet, causing it to attract an armature fixed to a moveable vertical lever having at its lower end a pencil, which marked on a strip of paper, passing slowly over a roller, zig-zags somewhat like the teeth of a saw.

To find out afterwards what the groups of zig-zags meant, one had to convert the digits they represented into numbers, and then look into the vocabulary for that number to learn what word was meant by it.

It was Dr. Leonard D. Gale, Professor of Chemistry, living in the same building as Morse, who had instructed him how to make the coils for an electro-magnet; he also procured him the necessary wire, and lent him a proper galvanic battery. Morse made him afterwards his partner, and he, from 1846, held, until lately, a situation in the Patent Office.

When, at the end of August, 1837, amongst other news from Europe, there came in a German newspaper (it was the "Neue Würzburger Zeitung," of the 30th June), an account of Steinheil's doings at Munich, which was translated into a New York paper on the 1st of September, there was, through Morse's influence, on the following day, an article printed, saying that the editors of newspapers in America, who copy such articles from European papers, do not seem to be aware, that the electric telegraph which now, as the wonder of the age, seems to have excited in Europe the attention of the scientific public, was an American discovery, and that Professor Morse had conceived it five years ago, on his return from France to America. It was added: "that Morse had on board the ship made no secret of the general idea, but communicated it freely to his fellow passengers of all nations, who were in the ship."

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* I must here remark that in works on the Electric Telegraph, printed in Great Britain and in America, is copied over and over again an article erroneously extracted from a memoir in German, by Julius Hülsse, in his journal "Polytechnisches Central Blatt (2nd and 7th June, 1838)." This article says: "It appears that Messieurs Taquin and Ettieyhausen (likewise written Entyihausen) established a line of telegraph across the streets in Vienna." These corrupted names stand for Baron Jacquin and Professor Ettingshausen, who made at Vienna the above mentioned experiments along with Baron Schilling.

† Breese is the family name of his mother, whose grandfather was the Rev. Samuel Finley.

Was not this to make the Americans believe that Baron Schilling, Steinheil, Weber, Gauss, Cooke and Wheatstone had learnt from their painter Morse the art of telegraphing by electro-magnetism? As it was also mentioned that Morse had his telegraph then at his lodgings, there came on the same day several curious persons to see "the wonder of the age." One of them was Dr. Daubeny, from Oxford, in England. Another was a young gentleman, Alfred Vail, who afterwards became very useful to Morse, for he, with his brother George, made at the Speedwell iron works near Morristown, in New Jersey, belonging to them, a much better instrument than that invented by Morse. Alfred Vail became, like Dr. Gale, Morse's partner.

On the day mentioned, the 2nd September, Morse's machine would not mark anything correctly. Great efforts were employed to make it do better, and two days later, on the 4th of September, Morse at last succeeded in getting by it the numbers representing five words and the date, marked. For this were wanted not less than sixty-two zig-zags, and fifteen straight lines on the slip of paper; the figure drawn on it, looking somewhat like a saw-blade, with teeth here and there broken out. They represented the following numbers: 215, 36, 2, 58, 112, 04, 01837. Searching in the vocabulary for the meaning of these numbers, it was found that they were to express: "Successful experiment with telegraph September 4 1837"

The triumph was immediately sent for publication to the editor of the last mentioned newspaper, and also to Professor Silliman at Newhaven, the editor of the "American Journal of Science and Arts," and with it was sent a representation of the wonderful production. It is to be seen on page 168 of the 23rd volume of the said Silliman's Journal; also in the London Mechanics Magazine of the 10th of February, 1838.

Morse wrote at that time: "I assert to be the first proposer and inventor of electro-magnetic telegraphy, namely, on the 19th October, 1832, on board the packet Sully, on my voyage from France to the United States. . . . All telegraphs in Europe are, without one exception, invented later than mine."

So spoke the painter Morse in America, after having with the machine, which Dr. Gale had assisted him to construct, on the 4th September, 1837, obtained the described poor result. He claimed priority to everything done in Europe in the department of telegraphy. His, for practical purposes, worthless result he had obtained four weeks after the death of our Baron Schilling, who, as we know now, had twenty seven years before that time, (1810) at Dr. Soemmerring's, at Munich, got acquainted with the first galvanic telegraph in the world, who, above a dozen years previous had made at St. Petersburg the first electro-magnetic telegraph, which he had himself two years before exhibited to the meeting of the Naturalists at Bonn, where it had so pleased that it was taken immediately to Heidelberg, and half-a-year afterwards from thence to England. Here a telegraph on the principle first used by Baron Schilling, had, forty-one days before the 4th September, been at work over a mile and a quarter of line at the terminus of the railroad, near Euston-square, in London, and Schilling had not long before his decease, at a rope manufactory at St. Petersburg, ordered a submarine cable to be made to unite Cronstadt with the capital through the Gulf of Finland for telegraphic correspondence.

It is to be regretted that Morse, when, in 1838, he with, and at the expense of, a commercially interested member of Congress, Francis O. J. Smith, came to Europe, wishing to get his apparatus patented in England and in France, was in Paris told that Baron Schilling had invented his electro-magnetic telegraph some time after his return from the frontiers of China, in December, 1832, and in 1833. This erroneous statement became for Morse a welcome encouragement to confirm to himself the ill-founded priority of October, 1832, and, unfortunately, in many works printed since that time, Baron Schilling is stated to have invented his telegraph in 1833.

We have seen what sort of a telegraph Morse, with the aid of Dr. Gale, had (in 1837) invented. It was a thing quite useless for practical purposes. Alfred Vail, with his brother, very soon after, made for Morse a better one, and, in the course of a good many years, a practically very useful instrument was brought about, which goes by the name of Morse's.

The first telegraph line in England was constructed by Mr. Cooke, from London (Paddington) along the Great Western railroad to West Drayton, in 1838-39. In 1840, he established the telegraph along the Blackwall railway, and, in 1841, along that between Edinburgh and Glasgow. In 1842-3, the line from West Drayton was continued to Slough. It served, on the 1st of January, 1845, to apprehend the murderer Tawell, which circumstance brought the telegraph at once into great repute and demand. In America, the first line, from Washington to Baltimore, was completed in 1844. On the 24th of March in that year, the first short sentence of four words was telegraphed along it. This sentence, in consequence of an invitation from Morse, was dictated by the daughter of his friend, the chief at the Patent Office, Mr. Ellsworth. I found this first American original telegram preserved in the Museum of the Historical Society at Hartford, in Connecticut, and have not failed to take an exact copy of it.

I do not intend at present to say more about the spreading of the telegraph in both hemispheres. My object here was to give a true and accurate account of the first begining of the art of telegraphing by means of galvanism.

I have shown that in the month of August this year (1859) it will be half a century since the first galvanic telegraph was made, and I have further demonstrated that it was the Russian Baron Schilling's electro-magnetic telegraph which, without its being known to be his, was brought to London, and caused the establishment of the first practically useful telegraph lines, not only in Great Britain, but in the world.

The small sprout, nursed on the Neva, which had been exhibited on the Rhine, and thence brought to the Thames, grew up here to a mighty tree, the fruit-laden branches of which, along with those from trees grown up since, extend more and more over the lands and seas of the Eastern hemisphere, whilst kindred trees, planted in the Western hemisphere, have covered that part of the world with their branches, some of which will, ere long, be interwoven with those in our hemisphere.

THE NEW THAMES GRAVING DOCK.

On Wednesday last a party of scientific, engineering, and commercial gentlemen attended, on the invitation of the directors of the company formed for establishing these docks, to witness an experiment for testing the efficacy of Mr. Edwin Clark's patent process for raising ships, by means of hydraulic pressure, for the purpose of examination and repair.

These docks are situated at North Woolwich, and are in connection with the Victoria Docks.

Under the old plan of graving, careening, or repairing docks it was necessary to excavate each dock to a depth sufficient to float the largest ship intended to be repaired, and to construct at the entrance of each dock a flood gate, or pair of gates, to keep the water out. For ships of the size now in common use the depth of a repairing dock must be about twenty four feet, causing a heavy expense for excavation and retaining walls of masonry, independently of the cost of the tidal gates. An entry into docks of this construction is effected at, or soon before, or after, high water. The gate is then closed; and at low water, on a tidal sea, the water is allowed to run out until the ship is left dry for examination or repair in a sort of pit, always damp, and in winter, soon dark. In tideless seas a graving dock must be emptied by the slow and expensive process of pumping. The new process obviates these difficulties and delays. A floating stage or pontoon is placed in a basin or water-way, and the vessel requiring examination or repair is floated upon it, and by the application of hydraulic pumps the stage, with the vessel upon it, is raised, and becomes a working platform, upon which the vessel, lifted up high and dry as in a dry dock, may be caulked or coppered or repaired as her necessities may require. The hydraulic lift consists of two parallel rows of sixteen cast-iron columns, each 5 feet in diameter, and 60 feet in length, sunk into the ground, under the water, about 12 feet. These columns are 20 feet apart in each row, and the clear space between the two rows is 60 feet. Each column contains a hydraulic press 10 inches in diameter, and of 25 feet stroke, the top of the press being at the ordinary level of the water. The ram of each press carries a small cross-head, from which are suspended, by means of descending rods, two wrought-iron girders 60 feet in length, which extend entirely across the dock to the corresponding column and press on the opposite side. There is thus a series of thirty-two suspended girders extending entirely across the dock; and when the presses are lowered, lying at the bottom of the dock in 28 feet of water; these form a large wrought-iron gridiron, which by means of the presses may, with a vessel upon it, be raised out of the water or lowered at pleasure. The vessel to be docked is not raised directly upon the gridiron, but upon a wrought-iron pontoon, proportioned to the size of the ship to be docked. This pontoon is first placed on the gridiron, and sunk with it to the bottom of the water. Then the ship is brought between the columns and over the pontoon, and a 50-horse engine working the hydraulic presses, raises the whole pontoon together. At this stage of the proceedings the pontoon empties itself of water through valves provided for the purpose; the valves are then closed, and the girdiron being again lowered to the bottom, the pontoon, with the vessel seated upon it, is left afloat on the surface. The shoring of the vessel (a work of difficulty and cost under the old plan) is accomplished by large moveable frames or sliding wedges, which, while under water, are drawn into close contact with the vessel, so that she sits on a huge timber cradle without the possibility of being strained. In less than 40 minutes a vessel drawing 19 or 20 feet of water is thus left afloat on a shallow pontoon, drawing only 4 or 5 feet. At the Victoria docks the lift consists of 16 columns, which give a working length of more than 340 feet. Perfect horizontality while lifting is secured, by arranging the presses in three independent groups. Those in each group are all connected together, so that perfect uniformity of pressure is secured as regards the individual presses in each group, while the three groups themselves are so arranged that their three centres of action form a tripod support, upon which the vessels and pontoon are seated, and any point of the tripod may be raised or lowered independently of the other two. By this process it is said that the Himalaya, one of the largest vessels in existence, may be completely docked in two hours, while from eight to ten ordinary vessels may be raised, examined, and launched again per day.

The floating pontoon has great advantages over the old pit-dock in light, air, and dryness. The men can work more hours in winter, paint dries more quickly, and there are no inconveniences from damp dark walls.

According to the statement of the company, the general advantages of the new system may be summed up under the following heads:—1. Independent of tides, and at all times, whether by night or by day, vessels of the largest dimensions, whether empty or loaded, may be raised out of the water for examination. 2. The vessel thus raised is transferred by floatation, without rails or slip, to suitable docks for its repair, where it lies high and dry on a convenient timber platform, on the same level as the repairing shops with which it is surrounded. In painting vessels, free exposure to the air is a most important advantage. 3. One single lift or apparatus for raising is sufficient for docking an unlimited number of vessels. 4. The method employed in raising and transporting vessels renders it impossible to damage them by any unequal strains. 5. The support of the vessel by cast-iron columns affords means of constructing such docks either in open water, in tideless seas, or in almost any locality, independent of the character of the soil.

The vessel experimented upon on Wednesday was a fine ship of 870 tons register, or some 1,200 tons burden, the Jason, an Aberdeen clipper, which was floated upon the stage, and by the application of the hydraulic pumps was in about twenty minutes brought up out of the water, and floated on the pontoon.

JAPAN WAX.

A hard, solid, vegetable wax has for some time been imported in small quantities from Japan, in small, thin, oval cakes, with Japanese characters, coming through Singapore and China. But since the opening of the Japanese ports to British traders, it has come forward in large quantities, in square blocks or cases of about a picul each, 133⅓ lbs. The American ship Florence brought over in April, about 500 tons, consigned to Messrs. Baring, Brothers, and samples of the bunches of fruit from which it is expressed, were also brought over. These fruits are, in appearance, like small shrivelled or unripe grapes. Small sales of this cargo have been made at 70s. per cwt.; but the bulk hangs on hand. Another vessel, the Versailles, with a large cargo of 500 or 600 tons, is expected daily. At Hamburgh, there has been an importation of about 374 chests of this wax. The following account of the Japan wax is from the *China Telegraph*, furnished by Mr. P. L. Simmonds:—

"The shrub or tree yielding this solid butter or fat, which is becoming such a large and important article of commerce, belongs to the *Anacardiaceæ* family. There are a great many species, and, as they are poisonous, the leaves and shoots should not be handled by children. Several of them yield, however, important commercial products. The dried and chopped leaves and shoots of *Rhus coriaria* and *cotinus*, under the name of sumach, form a large article of commerce in the south of Europe, and we import about 19,000 tons a year for the use of tanners and dyers. Containing a good deal of tannin, it is powerfully astringent, and is used to stain leather yellow. The juice of *Rhus radicans* and *R. toxicodendron*, North American species, is milky, stains black, and is extremely poisonous. *Rhus succedanea*, the species which furnishes the Japan wax, has long been grown in our greenhouses, having been introduced from China nearly a century ago. It might be raised, we should suppose, in the Cape and Australian colonies, in the Mauritius, and India; and would be far preferable as an oleaginous plant to the species of candle-berry myrtles from which wax is obtained. It will grow in any common soil, and may be readily increased by ripened cuttings. We shall probably soon learn what is the ordinary mode of culture in the plantations of Japan, and whether any attention is paid to manuring, pruning, &c. The wax is of medium quality, between beeswax and the ordinary vegetable tallows, such as Bassia butter, Borneo vegetable tallow, cocum butter, &c. Though there are shades of difference, several of these varieties of wax possess the essential properties of that formed by the bee; indeed, it was formerly supposed that bees merely collected the wax already formed by the vegetable; but Huber's experiments show that the insect has the power of transmuting sugar into wax, and that it is in fact a secretion. Japan wax is softer, more brittle and fatty than beeswax, easily kneaded, and melts between 40 and 42°. It contains twice as much oxygen as beeswax, and has a different composition, consisting of palmitic acid, united with oxide of glyceryle. The small parcels which formerly reached this country have been used in Price's patent candle-works, in substitution for wax, for hard neutral fat, and, after conversion into the acid state, both for candles and night lights. For the last, a mixture of Japan wax and fat of low melting point makes a compact, soft, waxlike body. If the wholesale price can be reduced, this wax will find its way into extensive consumption on the Continent for various purposes.

Home Correspondence.

SOCIETY OF ARTS EXAMINATIONS AND THE LOCAL BOARDS.

Sir,—It is but just to Yorkshire and many of the Institutions comprised in the Yorkshire Union, to state that great objection was taken at the annual meeting at Rotherham, to that part of the report which animadverted on the Society of Arts Examinations; and it was only because discussion on that part of it was reserved to a subsequent period of the proceedings, that the report was allowed to pass. As it was, when the discussion came on, it was a clear understanding from the chair that the report should be revised in committee. I exceedingly regret that so unfavourable an impression of Yorkshire's estimate of the Examinations should have got abroad. At home we wonder where it has come from. Bradford, Selby, Lockwood, and other places raised their voices against it, as expressed at Rotherham. As to fairness, we never heard of anything but the strictest, and were amazed at suspicions being raised. For my own part, though on the Yorkshire Union Committee, I strongly canvassed the animadverting paragraph in the report, although I had to betray thereby my unavoidable absence from the committee when it was adopted. Facts were wanting to support it. For these reasons I greatly regretted my inability to attend the Society of Arts' Conference, with a view of hindering an impression which I take the present means to counteract. I consider it but just that we in Yorkshire, and in the Yorkshire Union, should not suffer from the impression that is gone abroad.

I am, &c.,

J. H. RYLAND,

Late President of the Bradford Mechanics' Institute, and one of the Bradford Local Board of Examiners.

July 25, 1859.

LOCAL BOARDS AND THE YORKSHIRE UNION.

Sir,—I was glad to see the letter of "A Sheffield Whittle" in your last week's *Journal*, because the more publicity is given to the subject on which it treats, the greater will be the benefit likely to result. Your correspondent, in quoting the remark of Shakspeare that "suspicion ever haunts the guilty mind," has but fallen into the error from which many who were present at the Conference were not free. I cast no reflection upon the local examiners, and therefore no repudiation of the Sheffield representative was needed, and I can readily believe that the Sheffield Board, under the able presidency of the Rev. Canon Sale, was conducted with all propriety. This was not, however, the point at issue. It is felt as an inconvenience, if not a grievance, that, as Local Boards are constituted solely of those having local interests, and, consequently, local predilections, there cannot be that confidence in their proceedings that there would be if each examination were under the supervision of a stranger to the district. The want of confidence does not necessarily imply any suspicion of unfairness, but it is an axiom of British law that no man shall be judge of a cause in the result of which he has an interest. Besides this, many of the local examiners are unaccustomed to the duty, and, with every disposition to act fairly and to the best of their ability, may not always be the best fitted to ensure a faithful performance of conditions which are conveyed in printed instructions, and the necessity of which may not always be obvious.

I should regret exceedingly if it were supposed that I implied a charge of the slightest intentional unfairness, but when there is naturally a spirit of emulation as to the comparative results of the several examinations, it is not difficult to imagine that similar consequences may arise from involuntary negligence, and the scrupulously exact suffer in comparison with the well-meaning but less particular. It has been said that Cæsar's wife should be above suspicion, and if the certificates of the Society of Arts are to become legitimate objects of ambition for our young men, the conducting of the Examinations should be placed in the position of Cæsar's wife, and, notwithstanding the generous belief of "A Sheffield Whittle," be more entitled to general confidence than they now possess.

Your correspondent's alllusion to the fable of the fox does not say much for the sharpness which he assumes; and his remark that Yorkshire obtained one-third of the prizes without much assistance from the Institutions represented by Mr. Blake, is simply untrue, inasmuch as out of 115 successful candidates for certificates, 59 belonged to Institutes comprised in the Yorkshire Union. I may pass over his observation about riding the first horse until I can comprehend his allusion; remarking, however, that Yorkshire has, as far as numbers are concerned, kept the first place, and for the interests of Yorkshire alone has the question been raised.

However desirous the Yorkshire Union may be that the Examinations may be placed on a more satisfactory basis, there is not the slightest wish or intention to undervalue the good services of the Society of Arts; nor to deny them the honour which justly belongs to them. Nor is there the slightest ground for the assertion that the students belonging to the Yorkshire Union shrink from the contest, or are not up to the required standard, when the fact is recorded that out of of £29 awarded for prizes to Yorkshire, they had £16, and more than a moiety of the certificates.

It is to be hoped, however, that difference of opinion will not destroy the good feeling which does and ought to exist. All have the same end in view, and I trust that in the forthcoming preparations for the next examinations, there will be that generous rivalry which cannot fail to prove beneficial to both parties.

I am, &c.,

BARNETT BLAKE.

Leeds, 25th July, 1859.

ELECTRO-DEPOSITS ON ENGRAVED COPPER-PLATES.

Sir,—Were I to allow M. Joubert's observations on Electro-plating Engraved Plates, which appeared in your impression of yesterday, to pass unnoticed, it would be a silent admission on my part that my previous statements on the subject were erroneous.

I stated that:—"Practically speaking, 2000 impressions from a zinc deposit are as good as 5000 from an iron deposit, especially if the same means for re-coating apply to one as to the other."

In reply M. Joubert says "Now, suppose Mr. Bradbury receiving another order for 1,200,000 impressions, like the one he alludes to in his letter, and see the result. He would require to have 600 coatings, whereas, through my process, (as acknowledged by Mr. Bradbury himself), 225 coatings at most would only be required. Is Mr. Bradbury prepared to maintain that, in point of expense, labour, and saving of time, the result would be the same in both cases?"

In point of expense, the result is materially different. 600 electro-zinc facings cost (including material and labour) £33 15s.; 225 electro-iron facings would cost, according to M. Joubert's scale of charges, £303 15s.; though electro-iron facing ought not to cost more than one farthing per square inch. In all probability, too, more than 225 electro-iron facings, as executed by M. Joubert, would be required, as his electro-iron facings have varied from 1000 to 9000 impressions. My assertion is thus correct, both on scientific and practical grounds; and however *startling* it may appear, the assertion is nothing compared with the result.

The removal of the worn-out electro-iron or electro-zinc facing before re-coating is indispensable; if the electro-facings in either case could not be removed, the processes would be useless, the electro-facings forming, in the case of iron and zinc, actual thicknesses of metal; neither process will admit of a second deposit, the second electro-facing being not adherent enough to the first; even were it possible to make it so, the parts worn out in the first electro-facing show in the printed impression from the second. This, however, is not the case with an electro-nickel facing; the metal is so different, both in density and substance, that filling up any portion of the work, however fine, is an impossibility.

My practical knowledge (not my want of it, as M. Joubert observes) enables me again to state that electro-nickel facing, capable of yielding 5000 impressions, does admit of being re-coated, *ad libitum*, without destroying the integrity of the work, and without requiring the removal of each coating. There is no difficulty in removing an electro-nickel facing, if the plate, in the first instance, be prepared in a certain manner, so that the nickel facing upon it, as in the case of iron and zinc, may be removed by acid, if necessary.

Without such preliminary preparation, an attempt to remove an electro-nickel facing, either by electro or chemical means, *could* only be attended with absolute and irrecoverable injury to the plate.

Those who feel disposed to try electro-nickel facing will find that my statements are not only scientifically, but practically, true. All that need be said is, that no difficulty is experienced in the ordinary course of business in carrying out the substance of this communication.

I have no wish to interfere with M. Joubert's electro-iron-facing. My only desire is to make known certain results obtained from a series of experiments in this department of printing; and it appears to me that it is a course which ought to be pursued by every lover of his profession.

I am, &c.,
HENRY BRADBURY.

Whitefriars, July 26th, 1859.

RIFLED ORDNANCE.

Sir,—In order that good practical results may arise from the present system of rifling all heavy ordnance, the bore, at least, of the cannon must present a surface fit to receive and maintain the grooves, and the body of the gun must also possess sufficient tensile strength to resist the explosive power required to drive the enormous shot now in use.

If the surface of the bore, however polished, of the best cast-iron guns be examined with good eyes, or with a magnifier, it will be found to consist entirely of a series of pores and crystals, and the first fracture of a piece of cast-iron will at once display the cause, that is to say, it will present the appearance of a box of common kitchen salt, with the crystals very closely pressed together, but not in contact, in all points. Cast-iron alone, therefore, is a material utterly unfitted for our present practice with rifled ordnance, elongated shot, and long range.

If you will have the goodness to refer to the third volume of the *Journal of the Society of Arts*, you will find, at page 78, that I there first described and published, in 1854, the only mode of constructing guns that would bear the rifle grooves, and be of sufficient strength to resist the great explosive power now universally adopted. In the spring of 1856, my process of forming the bore of all heavy guns, by means of a spiral coil of mild steel in its soft state, or of the best wrought iron with a cast-metal jacket outside, was fully and unconditionally laid before the authorities of the War Department, but unfortunately the regulations of the Board of Ordnance entirely prevented its being carried out.

The authorities of the Royal Arsenal could not receive and subject to proof a working model that would only carry a spherical ball one inch and a half in diameter, such as I could construct with means at my own disposal; neither could they allow me to direct and superintend the construction of a larger piece adapted to such means as the Royal Arsenal then possessed, but they required me to produce, for trial and proof, a full-sized ten-inch gun, and when I stated that my means were utterly inadequate to do so, they directed me to apply to some of the great iron works. In accordance with that advice, I made application to several large iron and steel works, among others to the Gospel Oak Works, at Tipton; the Cyclops Steel Works, at Sheffield; the Mersey Iron and Steel Works, Liverpool, &c., and the answer was uniformly a polite but flat refusal to construct a single gun only, of a new form, even for the Royal Arsenal at Woolwich.

At this point of course the matter completely dropped, and now that the spiral-coil bored guns are coming into general use, I hope that the impartial justice you uniformly display may induce you to be kind enough to allow this statement to appear in your columns.

I am, &c.,
HENRY W. REVELEY.

Poole, Dorset.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 2nd and 4th July, 1859.

13. Bills—Poor Law Boards (Payment of Debts).
16. ,, Law of Property and Trustees Relief Amendment.
29. ,, Court of Probate, &c. (Acquisition of Site).
30. ,, Locomotive.
Italy (British Officers)—Correspondence.
Portugal (Communication by Post)—Convention.

Delivered on 5th July, 1859.

47. Constabulary (Ireland)—Statement.
50. Dover Mails—Copies of Contracts, &c.
57. Navy Estimates—Abstract and further Supplementary Estimate.
31. Bill—Weights and Measures Act Amendment.

Delivered on 6th July, 1859.

52. National Collections—Return.
32. Bills—Public Health.
33. ,, Clerk of the Council.

Delivered on 7th July, 1859.

63. Post Office Department (Packet Service)—Estimate.
61 (2). Army—Supplementary Estimate, &c.
65. Committee of Selection—3rd Report.
68. Navy (Screw Steamers)—Return.
69. Navy (Ships and Vessels)—Return.
70. Navy (Dockyards)—Return.
62. Navy Estimates.
17. Bills—Criminal Procedure.
18. ,, Public Justices Offences.
19. ,, Malicious Injuries.
20. ,, Coinage Offences.
21. ,, Personation.
22. ,, Forgery.
23. ,, Offences against the Person.
24. ,, Larceny.
25. ,, Criminal Writings.
26. ,, Punishment.
27. ,, Oaths, &c.
28. ,, Grain, &c.
35. ,, Law Ascertainment Facilities.
36. ,, Admiralty Court.
39. ,, Roman Catholic Relief Act Amendment.
40. ,, Church Rates Commutation.
Inland Revenue—3rd Report of Commissioners.

Delivered on 8th July, 1859.

61. Army Estimates.
61 (1). Army Supplemental Estimate.
67. Hocquard *v* the Queen—Return.
37. Bill—Salmon Fishery.

First Session, 1859.

208 (A 1). Poor Rates and Pauperism—Return (A).

Delivered on 9th and 11th July, 1859.

59. Revenue Departments—Estimates.

60. Civil Contingencies—Account and Estimate.
73. Public Income and Expenditure (Balance Sheet)—Account.
58. Civil Service Estimates—Classes 1 to 6.
74. Railway and Canal Bills—3rd Report from Committee.
71. Railway and Canal Bills—Board of Trade Report.
33. Bills—Tramways (Ireland).
44. „ Highways.
Right of Visit—Correspondence with the United States Government.

Delivered on 12th July, 1859.

48. East India (King of Delhi)—Copy of a Letter.
49. East India (Judicial Procedure)—Copy of Despatch.
53. Exchequer—Account.
72. Turnpike Roads and Bridges (Essex)—Returns.
78. Statute Law Consolidation—4th Report of Commissioners.
45. Manning of the Navy—Papers.
41. Bills—Railway Companies Arbitration.
45. „ Criminal Justice (Middlesex) (Assistant Judge)—(Amended).
46. „ London Corporation.

Delivered on 13th July, 1859.

55. Loan Societies—Abstract of Accounts.
76. Proprietors (Scotland)—Return.
83. National Portrait Gallery—2nd Report of the Trustees.
85. Navy—Supplementary Estimate.
34. Bills—Diplomatic Pensions.
43. „ Metropolis Carriage-ways.
47. „ Judgments (Ireland).
48. „ Westminster New Bridge.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, July* 22, 1859.]

Dated 27th May, 1859.

1310. L. D. Jackson, 32, Finsbury Market, Finsbury—An improved machine for cutting wood.

Dated 22nd June, 1859.

1498. W. Buckwell, Phœnix Stone Works, East Greenwich—Manufacturing materials for building and other structural purposes, and of the machinery applied thereto, which last invention is applicable to other purposes.

Dated 23rd June, 1859.

1510. A. J. Dessales, 13, Rue des Enfants Rouges, Paris—An imp. in the working and securing of sliding tubes, applicable to gas chandeliers, lamps, and other purposes.

Dated 30th June, 1859.

1554. A. Gueyton, Paris—Imp. in enamelling articles of jewellery, applicable also to other similar purposes.

Dated 5th July, 1859.

1598. J. H. Nalder, Alvescott, Oxfordshire, and T. Nalder, Challow Works, Berkshire—Imp. in winnowing and dressing grain and seeds, and in the machinery or apparatus employed therein.

Dated 6th July, 1859.

1600. W. H. Ward, Auburn, Cayuga, U.S.—Ocean marine signal telegraphing for day and night, whereby messages and communications on all occasions and subjects may be given with clearness and despatch, within seeing distance, day or night.

1608. B. Seed, Keighley, and T. Steel, Bradford—Imp. in apparatus employed in the treatment of soap suds or other saponaceous or oily matters.

Dated 7th July, 1859.

1610. D. T. Jones, Headless Cross, Ipsley, Warwickshire—Imp. in ploughs.

1611. C. F. Vasserot, 45, Essex-street, Strand—An improved form of regulator, chiefly applicable to water wheels. (A com.)

1612. F. A. Le Mat, New Orleans, U.S.—Imp. applicable to ordnance.

1614. R. C. Rapier, Newcastle-upon-Tyne—Imp. in working rolls for rolling plates of unequal thicknesses.

1618. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in knitting-frames. (A com.)

Dated 8th July, 1859.

1619. G. Ellis, 4, Collier-street, Pentonville—The imp. of muffs, to be called "the patent reticule travelling muff."

1620. W. H. Dawes, Bromford Iron Works, West Bromwich, Staffordshire—An imp. or imps. in the manufacture of iron.

1662. F. A. Le Mat, New Orleans, U.S.—Imp. in the construction of revolving or repeating fire-arms.

1624. G. Cartwright, Birmingham—Imp. in corks for bottles and jars

1625. G. A. Boggis, Croxted-place, Dulwich, Surrey—Imp. in rendering boots and shoes waterproof.

1626. E. Livermore, New York, U.S.—Imp. in the manufacture of burning fluids for illuminating and heating purposes. (A com.)

1627. D. Mathews, Esbald Well Brewery, Oulton, near Leeds—Imp. in apparatus for refrigerating and heating liquids.

1628. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in moulding or shaping metals by pressure, and in the machinery or apparatus employed therein. (A com.)

1629. W. H. Harfield, Fenchurch-street—Imp. in ships' capstans and riding bits.

1630. H. Brinsmead and J. Lawrence, Ipswich—Imp. in rotatory screens.

1631. J. Taylor, Roupell-park, Streatham-hill, Surrey—Imp. in the construction of walls to prevent damp from rising, and also in tiles to be used for this purpose in building walls.

1632. T. D. Duppa, Longville, Winstanton, Shropshire—Imp. in carpenters' benches.

1633. W. Woof, Gloucester—Imp. in ploughs.

1635. W. N. Nicholson, Newark-on-Trent—Imp. in clod crushers and land and garden rollers.

Dated July 9th, 1859.

1636. M. Henry, 84, Fleet-street—Imp. in the manufacture of overshoes and other articles worn on the feet, and in the apparatus employed therein. (A com.)

1637. B. Samuelson, and J. Shaw, Britannia Works, Banbury—Imp. in reaping and mowing machines.

1638. F. Ayckbourn, 27, Henry-street, Vauxhall-gardens, Surrey—Constructing certain articles of dress, so as to prevent drowning.

1639. C. Iliffe, Birmingham—Imp. in the manufacture of buttons.

1641. E. Livermore, New York, U.S.—Imp. in generating gas for the purpose of lighting and heating.

1642. J. Smith, Bradford, Yorkshire—Imp. in apparatus for heating and cooling water.

Dated July 11th, 1859.

1643. E. F. Hutchins, Albert cottages, Perry-street, Northfleet, Kent—Constructing the jaw or jaws of vices, and holding tools in general with a ball and socket joint.

1644. R. Clegg, Islington—Imp. in machines for cutting wood and metal, and in the means of fixing saws thereto. (A com.)

1645. H. Davies, 13, Leicester-buildings, King-street, Liverpool—Imp. in the manufacture of soap.

1646. J. C. Pickard, Burnley, Lancashire—Imp. in weft forks for looms.

1647. W. E. Newton, 66, Chancery-lane—Imp. in magneto-electric machines. (A com.)

1648. J. Dible, Northam, Hants, and W. H. Graveley, Upper East Smithfield—Imp. in apparatuses for ventilating and lighting ships.

1649. F. Burden, John street, Adelphi—Imp. in the permanent way of railways.

1650. J. A. Hartmann, Mulhouse, France—Imp. in the manufacture of colours for printing cotton and other vegetable fibres and silk.

Invention With Complete Specification Filed.

1690. M. Cranston, 11, New Broad-street—Improved delivery apparatus for harvest machines. (A com.)—July 16, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, July* 22, 1859.]

July 22nd.

202. B. Templar.
203. E. Dorsett & J. B. Blythe.
212. R. A. Brooman.
213. J. Laubereau.
214. J. Smith and W. H. Smith.
215. J. Savory & W. R. Barker.
217. A. Warner and W. Tooth.
227. J. White.
238. D. Graham.
240. F. C. C. Paulsen and A. Alsing.
370. W. E. Newton.
395. T. Willis and G. Chell.
617. A. V. Newton.
833. T. Richardson and G. W. Jaffrey.
851. L. Brierly and H. Geering.
1263. W. Crum.

[*From Gazette, July 26th*, 1859.]

July 26th.

246. E. Dixon & H. Whittaker.
253. W. Crowther.
254. J. Gathercole.
255. I. Zacheroni.
259. F. Prince.
266. J. Mackenzie.
270. J. J. A. de Bronac, and A. J. M. Deherrypon.
272. T. P. Smith.
274. J. Raywood.
289. R. A. Brooman.
297. E. Wilkins.
307. T. Storer.
330. W. Clark.
342. M. Curtis and J. Miller.
343. J. Lee.
359. T. S. Cressey.
373. H. P. Burt.
388. R. Cogan.
390. C. Jackson.
412. J. L. Clark.
451. C. Garton.
529. J. H. Johnson.
662. H. Ambler.
875. J. Bindley and J. L. Hinks.
948. J. Chapman.
1158. J. Luis.
1228. C. Law.
1319. W. Crum.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, July* 22, 1859.]

July 18th.

1707. W. A. Jump.
1708. W. A. Jump.
1711. W. Papineau.
1748. H. Doubleday.

July 19th.

1719. J. Clark.
1725. J. E. Hodges.
1742. J. Onions.
1749. J. Derbyshire.

July 20th.

1715. E. Leak.
1729. C. Amet.
810. W. E. Newton.
1984. W. H. Perkin.

[*From Gazette, July 26th*, 1859.]

July 21st.

1768. T. Byford.
1793. J. Knowles & W. Buxton.
2021. H. Conant.

July 22nd.

1741. F. Potts.
1759. G. A. Copeland.
1781. S. Yeadon & G. Chapman.
1834. N. Cadiat.

July 23rd.

1760. C. T. Judkins.
1766. E. Lord, T. Lord, A. Lord, and W. Lord.
1770. T. Wrigley.
1776. J. Denis.

Journal of the Society of Arts.

FRIDAY, AUGUST 5, 1859.

NOTICE TO CANDIDATES.

The Certificates are in preparation, and will shortly be sent to each Local Board for distribution among the successful Candidates.

PROGRAMME OF THE EXAMINATIONS FOR 1860.

The Programme of the Examination for May, 1860, is now published, and two copies of it are sent by this day's post to each Institution in Union.

JAPAN WAX.

Specimens of this substance,* and of the seeds of the plant from which it is procured, have been deposited at the Society's House, and may be inspected by all those interested in such products.

EXHIBITION OF 1861.

Mons. Barbedienne, of Paris, so well known for his bronzes d'art, and who received the highest medals for his works, both in 1851 and 1855, says, in writing to his correspondent in London, under date of July 31st:—

"Now that peace appears to become more firm every day, will it not be possible to return to your project for the Exhibition of 1861?

"It appears to us that it is the duty of Commerce and Industry to rely with confidence on the interests of nations, and to discard all foolish and transient causes of antagonism and strife.

"In the actual state of things, a Great Exhibition in London would have a double salutary effect, both in the industrial as well as in the political world."

"Personally, I will do everything in my power to promote so noble and excellent a cause."

EXAMINATION PAPERS, 1859.

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

ARITHMETIC.

THREE HOURS ALLOWED.

(1.) A house contains 15 windows, and each window 16 squares, each measuring 21 inches by 16 inches. What will be the expense of glazing the whole at $10\frac{1}{2}$d. per square foot?

(2.) After using $\frac{2}{5}$ths. of a cheese, $\frac{2}{3}$rds. of the remainder sold for £1 2s. $5\frac{1}{2}$d., what was the whole cheese worth?

(3.) Convert £147 11s. $7\frac{3}{4}$d. and £69 15s. $9\frac{1}{4}$d. into a decimal currency, £1 being the unit; then find the difference, and divide it among 24 men, expressing the result in the present currency.

(4.) Work the following by decimal currency. If 27 persons spend £127 11s. 6d. in seven weeks, how many weeks would £145 16s. last nine persons?

(5.) A railway company pays 8 per cent. upon the original shares of £60, what rate of interest shall I receive when I purchase shares at £20 premium?

(6.) What would a banker gain by discounting, on September 21st, a bill of £318 3s., dated July 31st, at 4 months, at 5 per cent.?

(7.) What would be the difference in annual income from investing £3,450 in the 4 per cents. at 92, and the $3\frac{1}{3}$ per cents. at 69?

(8.) Find what decimal multiplied by 36 will express the sum of $\frac{1}{8}$, $\frac{7}{16}$, $\frac{11}{12}$, and $4\frac{1}{4}$.

(9.) By selling goods at £3 14s. 6d. per cwt., which cost me 50s. per cwt., I gained two guineas, what quantity did I buy?

(10.) A person contracted to complete 500 yards of railway in 40 days, and hired 120 men for that purpose; but at the end of 25 days he finds only 200 yards finished. How many more men must he employ to finish the work in the given time?

(11.) A. has goods worth 15s., which he charges to me at 15s. 6d., allowing 6 months' credit. I in return give him goods worth 40s., charging him two guineas. How long credit should I give him to make the transaction equitable?

(12.) Two men shoot by turns at pigeons let out of a trap; the one hits 3 birds out of 5, the other 5 out of 8. How many shots must each have to kill 98 between them?

(13.) A railway train having performed a journey at $\frac{3}{5}$ths. of its proper speed, arrived at the terminus two hours and a half behind time. In what time should the journey have been performed?

(14.) If the area of the British Islands be 91,000 geographical miles, or 122,000 statute square miles, find the length of a geographical mile correct to two places of decimals in inches.

(15.) Find the cost of a mirror, with a frame three inches wide, if the glass be 2ft. 8in. long and 1ft. 10in. broad, at 3s. 6d. a square foot, the cost of the frame being 11d. per lineal foot.

(16.) Of the adult male population in a village, the proportion of those who are labourers is 11 in 20; of tradesmen, 7 in 24; of professional men, 9 in 80; and there are besides 33 gentlemen—how many male adults in all?

(17.) English gunpowder contains 75 per cent. of nitre, 15 per cent. of charcoal, and 10 per cent. of sulphur, and a mixture of equal quantities of English and French gunpowder contains 76 per cent. of nitre, 14·5 per cent. of charcoal, and 9·5 per cent. of sulphur. Find the per centage of each ingredient in French gunpowder.

(18.) The circumference of the fore wheel of a carriage is $6\frac{1}{2}$ feet, and that of the hind wheel is $8\frac{1}{2}$. When the fore wheel has made 200 more revolutions than the hind wheel, what is the distance travelled?

(19.) Two travellers sit down to a meal, one has 5 loaves, the other 3. They are joined by a stranger who shares equally with the other two. All the loaves are eaten, and, on departing, the stranger gives to one of the travellers 3 pieces of money and to the other 5. Was this an equitable payment? If not, find how many pieces he should have given to each.

(20.) Two third-class passengers, for the same journey, are charged 3s. 4d. and 8s. 4d. respectively, for excess of luggage. Had the luggage all belonged to one of them, he would have been charged for excess 35s. How much would they have been charged, if no luggage had been allowed free?

(21.) A hat which cost 10s. will last 7 months, and one which cost 18s. will last 13 months; which is the cheaper? How much would be saved at the end of 3 years by wearing the cheaper kind of hat rather than the other, allowing simple interest at 5 per cent. per annum?

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* See last number of the *Journal*, p. 611.

BOOK-KEEPING BY DOUBLE-ENTRY.

THREE HOURS ALLOWED.

(1·) What is the distinguishing feature or principle of the double-entry method of book-keeping, as compared with that of single-entry?

(2.) Does the double-entry system provide absolute security for the prevention or detection of every kind of error or mistake to which the book-keeper is liable?

Note.—*State reasons for the answer to the question.*

(3.) Specify the principal books usually adopted in keeping accounts by the system of double-entry, and their respective uses.

(4.) Can the principle of double-entry be maintained in the keeping of any set of accounts without a Journal?

(5.) Adopting the ordinary division of accounts under the several titles of ***Real***, ***Personal***, and ***Impersonal*** (or *Nominal*), state what is the proper object of each of those heads of account.

(6.) Write out in proper technical form the Journal entries of the following transactions, viz.:—

Purchased of John Vulcan, 200 tons of iron at £5	£1,000
,, of Cyclops and Co., 100 tons of iron at £4 10s.	450
Sold to Mars and Co., 500 tons of iron at £6	3,000
Paid Cash to John Vulcan.....................	1,000
,, ,, to Cyclops and Co.	450
Received Cash of Mars and Co. on account	2,000

(7.) Post the same transactions to appropriate Ledger Accounts.

(8.) What facts should be entered respectively on the *credit* and *debit* side of a Profit and Loss Account, and what should its final result exhibit?

(9.) What is the distinction between *Gross* and *Net* Profit?

(10.) In the case of a ship-builder, for example, how should the wages paid to mechanics and artisans be treated with reference to the distinction between *Gross* and *Net*-Profit?

(11.) What is a Trial Balance, and what purpose does it serve?

(12.) What should a Balance Sheet exhibit?

(13.) Work out the following supposititious facts and transactions of a month by double entry, through the Journal and Ledger in proper technical form, and produce:—Firstly, a Trial Balance; and, secondly, a Balance Sheet accompanied by a Profit and Loss Account.

Note.—It is not *required* in this exercise that the distinction between *Gross* and *Net* Profit be attempted.

On the 1st of January, 1859, Henry Grey commenced business with a capital of £2,000, which consisted of:—

Cash		£1,000
Bills receivable:—		
Due 20th Jan.	£100	
,, 4th May	150	
	——	250
Iron		750

	Total .... ———	£2,000	0	0
Jan. 10.	Purchased of Vulcan and Co., iron	£2,000	0	0
,, 12.	Purchased of Cyclops and Co., do.	450	0	0
,, 12.	Sold to Mars and Co., do.	3,000	0	0
,, 12.	Received of Mars and Co., their acceptance, due 4th April	1,000	0	0
	and cash..............................	1,500	0	0
,, 13.	Discounted with John Gride, Mars and Co's. acceptance, due 4th April, for	1,000	0	0
,, 13.	Received from John Gride, cash,	990	0	0
	and allowed discount to him ...	10	0	0
,, 14.	Accepted Vulcan's and Co's. draft, due 4th May........................	2,000	0	0
Jan. 15.	Purchased of Vulcan and Co., iron	800	0	0
,, 16.	Paid cash to Vulcan and Co., in settlement of the foregoing purchase	770	0	0
	On being allowed by them an abatement of.......................	30	0	0
,, 16.	Accepted Cyclop and Co's. draft, due 30th instant, in part payment of iron purchased of them	200	0	0
,, 16.	Cash paid to Cyclops and Co. ...	250	0	0
,, 17.	Cash paid for 2 weeks' wages, to labourers	30	0	0
,, 17.	Cash paid Freight on account of iron	140	0	0
,, 17.	Cash paid Clerks' Salaries	20	0	0
,, 18.	Cash received of Mars and Co., they having failed 10s. in the £ in discharge of balance of £500 due from them.........	250	0	0
,, 18.	Write off loss by Mars and Co....	250	0	0
,, 18.	Cash lent to John Minus at 5 per cent. interest	1,000	0	0
,, 19.	Cash paid for horse-keep.........	15	0	0
,, 20.	Sold to Bellona, iron	650	0	0
,, 20.	Sold to Argus, iron	380	0	0
,, 20.	Received from Bellona, her acceptance due 31st instant ...	650	0	0
20.	Received cash for bill receivable due this day..........	100	0	0
,, 21.	Cash paid for petty cash disbursements, to be accounted for	£ 20	0	0
,, 22.	Bought of Tubal Cain, iron	780	0	0
,, 23.	Sold to Mercury, iron	600	0	0
,, 30.	Cash paid, acceptance in favour of Cyclops and Co., due this day,	200	0	0
,, 31.	Charge John Minus with interest of loan of £1,000 to this day	2	1	8
,, 31.	Interest on capital, one month, on £2,000	8	6	8
,, 31.	Rent of counting-house, due to John Nokes	15	0	0
,, 31.	Drew out cash on private account of H. Grey	300	0	0
,, 31.	Cash paid, two weeks' wages to Labourers..........................	30	0	0
,, 31.	Stock of Iron on hand, at this date	850	0	0

Nota bene.—Candidates who reply to No. 13 need not reply to either No. 6 or No. 7; but "Satisfactory Answering" in No. 13 will be deemed an indispensable condition of "a High Degree of Excellence."

ALGEBRA.

THREE HOURS ALLOWED.

(A.)

(1.) Add together the following quantities:

$$15\,a^3 - 21\,a^2b + 24\,ab^2 - b^3,$$
$$-2\,a^3 + 4\,a^2b - 12\,ab^2 + 2b^3,$$
$$\text{and } 12\,a^3 - 8\,a^2b + 13\,ab^2 + 24b^3.$$

(2.) Subtract $2a - 2b + 3c - 3d$, from $3a + 6b + c + 3d$.

(3.) Multiply $a + a^{\frac{1}{2}}\,b^{\frac{1}{2}} + b$, by $a - a^{\frac{1}{2}}\,b^{\frac{1}{2}} + b$.

(4.) Divide $x^6 - 6\,x^5\,y + 15\,x^4\,y^2 - 20\,x^3\,y^3 + 15\,x^2\,y^4 - 6\,x\,y^5 + y^6$ by $x^2 - 2\,xy + y^2$.

(5.) Find the highest common divisor of the expressions $x^6 + x^2\,y - x^4\,y^2 - y^3$, $x^4 - x^2\,y - x^2\,y^2 + y^3$.

(6.) Solve the following equations:—

$$\frac{x-1}{2}+\frac{2x-7}{3}=x-2$$

$$\frac{x}{x-1}+\frac{x-1}{x+1}=\frac{7}{3}$$

$$\left.\begin{array}{l} x^3+x^2y+xy^2+y^3=15 \\ x+y=3. \end{array}\right\}$$

(7.) A ratio of greater inequality is increased; and a ratio of less inequality is diminished, by taking from both terms of the ratio any quantity which is less than each of those terms.

(8.) The wages of 5 men for 6 weeks being £14 5s., how many weeks will 4 men work for £19?

(9.) If one solution of a quadratic equation be imaginary, prove that the other is also imaginary.

(10.) Eliminate x from the two equations:—

$$ax^2+bv+c=0$$
$$a_1x^2+b_1x+c_1=0$$

(B.)

(11.) What is the interpretation of the symbol $a^{\frac{1}{n}}$? On what principle do you assert that $a^{\frac{1}{m}}\times a^{\frac{1}{n}}=a^{\frac{1}{m}+\frac{1}{n}}$?

(12.) Show that every quadratic equation has two roots and no more.

(13.) Investigate the method of finding the cube root of a polynomial expression; and hence explain the process of finding the cube root of a number. How could you most easily in practice find the cube root of a numerical quantity.

(14.) When is one quantity said to *vary* as another? If $ax^2+by^2 \propto xy$, then $ax^4+by^4 \propto x^2y^2$.

(15.) A pedestrian starts 4 hours before a coach; both travel uniformly, and the coach overtakes the pedestrian after a certain number of hours. From this point the coach increases its speed in the ratio of 6 to 5, while the man increases his in the ratio of 5 to 4, and they continue at these increased rates for 12 hours longer than it took the coach to overtake the man. They are then 92 miles apart; but had they continued for the same length of time at their original rates they would have been only 80 miles apart. Find the original rates of the coach and man respectively.

(16.) Determine the condition which must be satisfied in order than the expression x^2+ax+b may always be positive, whatever value be assigned to x.

Can any similar condition be found for the expression x^3+ax^2+bx+c?

(*To be continued.*)

THE CHINESE GREEN COLOUR *LO-KAO*, AND SOME OTHER DYES.

By Professor S. Bleekrode, Delft.

In 1846, cotton goods dyed by a vegetable green colour were introduced and exhibited by the French commissioners, for the trade of China, at Lyons, St. Etienne, &c., and other sorts, forwarded by M. de Montigny, the French consul at Shang-hai, were exhibited by the Chamber of Commerce, at Mulhouse, Rouen, and Lille. Mr. Daniel Koechlin-Schouch was the first who, in 1848, directed attention to the characteristic green dye, applied in such a way that only one side was coloured, the reverse being nearly without colour. This observation was made by the chemist to the firm of Koechlin and Benzard, at Rouen, in 1854. It was stated that this green colour was not a mixture of blue with yellow, but a pure and simple green, distinguished from all the other shades of that colour by its remaining pure in artificial light.

In 1852, the genuine green colouring matter was forwarded, by Mr. P. S. Forbes, the consul of the United States, to M. Persoz, at Paris; a small quantity (only one gramme) being divided between M. Koechlin-Schouch (Mulhouse), M. Guinon (Lyons), and M. Espinasson (Rouen).

In October of the same year, M. Persoz made his first report to the Académie des Sciences, and in November immediately followed a communication by Professor Seringe to the Chamber of Commerce, at Lyons. This Chamber requested M. Natalis Rondot to procure five kilogrammes (11½ pounds avoirdupois weight) from China. This order was executed by Mr. D. Remi, at Shang-hai, and in October, 1853, were received 160 taels = 5.59 kilogrammes, valued at 2,158 francs 33 cents. Several months before, however, M. Guinon was in possession of 256 taels of first quality, and two taels of second quality, bought by Messrs. Carvalho and Co., at Canton.

Towards the end of 1853, the same colouring matter was imported by the Dutch consul at Amsterdam. The results of the examination by Mr. Walter Crum and Mr. Mercer, of a small parcel sent over by M. Persoz, were published in Appendix L to the First Report of the Department of Science and Art, p. 432. Mr. Mercer ascertained the identity of the Lo-kao with the green colour of the Chinese cotton goods, and was of opinion that it was applicable for steam and self-dyed colours. Mr. Walter Crum considered it useless to the dyer unless means were found of dissolving it like indigo. Notwithstanding these inquiries, the firm of Halliday, Pochin and Co., at Salford, owing to a lecture delivered by Mr. Crace Calvert, in December, 1852, applied to the Board of Trade, that some investigations relating to this matter in China might be ordered to be made. Mr. Meadows, interpreter at Ning-po, forwarded, in 1853, the *Hwae-hwa*, being the undeveloped flowers or buds of the *Sophora japonica*, already cultivated in Kew gardens, and at Lyons, since 1847. (Annales de la Société Royale d'Agriculture de Lyons, March 1847). The firm of Renard, père et fils, tried it for dyeing silk yellow. It was introduced into Germany under the name of "Chinesisch Gelb-beeren" (yellow berries of China), and "Natalkörner" (grains of Natal). W. Stein, von Kurrer, &c., have published the results of their chemical and practical experiments. (Pharmac. Centralblatt, 1853, pp. 193 and 845.) The same material was forwarded by the Dutch consul, who stated that it was employed to produce the green dye on cheap cotton cloth.

Mr. Sinclair, interpreter at Emoei, sent in a report relating to the same substance. It appears, from both communications, that this yellow was applied on a blue ground to produce a green, but this was not the direct and actual production of a green dye with Lo-kao. It was quite true, as Mr. Mercer says, that the *Hwae* failed in giving any indication of green. Mr. Walter Crum says: the substance produces a yellow dye, which in China "becomes green by an exposure of some duration to the sun; but here, after three or four days there are only signs of such a change being about to take place." But this was a supposition. The Chinese are careful to avoid the direct action of the sun on their cloths of Lo-kao-green. Mr. Sinclair says, that the cotton cloth is spread out on the ground in the open air, but not after the hours of nine and ten, when the sun becomes too powerful.

During and after the Paris Exhibition of 1855, the value of the Chinese colour applied to silk, became more and more appreciated. The *nouveautés* of this shade were much admired for the splendour and purity of their colour by artificial light, when the usual mixed green colours change to blue. The "Velours épinglé et coupé en vert Vénus" exhibited by the firm Gaudre et Co., occu- the first position among the articles of fashion during the spring of 1855. In July following, a new shade, obtained by mixing with yellow, was produced, under the name "Vert-Azof," and in August, evening dresses so dyed were sold by Million and Co., and in October and November in the Magazins of Heckel, Teillard, and Ponson. Relating to the application of the Lo-kao, M. Michel and M. Guinon have the merit of discovering the best method of dissolving it for dyeing silk. M. Guinon has kept the method secret.

From April 1855-56, he has dyed 1500 kilogr. silk.
,, 1856-57, ,, 3500 ,,
with this colouring matter.

M. Michel has published his valuable investigations, which have been printed by order of the Chamber of Commerce at Lyons ("Rapport sur le Vert de Chine," par M. A. F. Michel, imprimé par ordre de la Chambre; Lyons, 1856). In 1857 a new paper was published by the same Chamber ("Concours pour la recherche du vert de Chine, dans les végétaux indigènes et exotiques"). The value of Lo-kao was confirmed by its increased use for dyeing silk, the quantity imported during the first six months of 1857 being 1100 lbs., of the commercial value of nearly £8000; from this it is evident how considerably its application in France has increased. The prices are variable; they ranged in China from 24 to 25 piastres per *katty* (0·6045 kilogr. = 1⅓ lb.) At Lyons the kilogramme was sold at from 700 fr. to 500 fr. There are several qualities, the first being the original from Soetsjeoe-foe; then follows the second, from Canton; and the third is prepared at Emoei, being the least valuable.

The Lo-kao of commerce is not a pure organic substance. Even when genuine it contains 30 per cent. of inorganic matter, which remains as ashes after incineration. I found 30.60 per cent. It contains from 9 to 10 per cent. of water. It is properly a mixture of finely-divided colouring matter with clay, so that nearly one-third of such a costly substance is of no use at all.

100 parts of ashes give substances—

Soluble in water	1·96
Soluble in hydrochloric acid ...	45·00
Insoluble..............................	53·04
	100·00

The constituents of the ashes are not from impurities, notwithstanding that on the last occasion some were detected. It appears to be impossible to avoid these by the Chinese method of preparation, for the Lo-kao is not a simple exsiccated vegetable juice, like the indigo or other colouring matters.

The Chamber of Commerce at Lyons, after offering a premium of 6000 fr. for the preparation, &c., of a genuine pure dye matter, like the Chinese Lo-kao, published the above-mentioned paper, "Concours, &c.," containing several communications relating to this substance. The most interesting was that of the Rev. Père Hélot, being a description of the Chinese plants, of the process of dyeing at Azé, and of the preparation of Lo-kao. A communication of a similar character was forwarded by the Dutch interpreter at Emoei, M. de Grys, dated 30th May, 1857 ("Journal de Volksvlijt," Nov., 1857). The other documents are—a letter of M. Aymery, Procureur des Missions des Lazaristes at Ning-po, dated 22nd August, 1856; and one from the Rev. T. Edkins at Shang-hai, containing some explanations, but no contradictions. There was also published a report of the Agricultural Society at Calcutta upon the experiments of Mr. Murray for cultivating the Chinese plants in the garden of the Society, dated March, 1854. Mr. Fortune forwarded the plants and seeds to Calcutta. M. Persoz, at Paris, who in 1857 was invited by the Agricultural Society of Calcutta to report on several materials, received only one piece of cloth of the original green colour. Living plants have been forwarded by M. de Grys to Holland, and received in May, 1857; they are at present in the Botanical Gardens at Leyden.

M. Natalis Rondot, celebrated for his profound knowledge of the Chinese and Oriental trade and commercial science, has the special merit of having indicated and assisted in importing plants and seeds of the vegetables from which the *Lo-kao* is prepared by the Chinese. He distributed the seeds from which plants have been cultivated at Lyons, Paris, Ghent, &c.

It had been already stated by the Rev. Père Hélot that the Chinese employed two different sorts of plants, one with a *white* bark, Pa-bi-lo-za, and another with a brown bark, Hom-bi-lo-za; one growing wild, and the other cultivated; but till the return of Dr. Lockhart from China, in 1857, it had not been possible to decide this. The Pa-bi-lo-za is the *Rhamnus chlorophorus*, of Decaisne, and grows wild, the Hom-bi-lo-za is *Rhamnus utilis* of Decaisne, the cultivated plant. The first was introduced into Europe by M. Rondot, and was formerly called by Prof. Seringe, at Lyons, *Rhamnus sinensis;* the other by Mr. Fortune, and is now cultivated at Acton-green by Dr. Lindley, and at Turnham-green by Mr. Gledinning; at Ghent by Mr. Van Houtte, etc.

M. Natalis Rondot published, at the commencement of last year, an admirable paper, by order of the Chamber of Commerce, entitled "Notice du vert de Chine et de la teinture en vert chez les Chinois, suivie d'une étude des propriétés chimiques et tinctoriales du Lo-kao, par M. T. Persoz, et de recherches sur la matière colorante des nerpruns indigénes, par M. A. F. Michel, Lyons, 1858." This valuable work gives a review of whatever is at present known relating to this specialty.

The Lo-kao does not contain any principle that resembles the constituent of indigo, although it has been often spoken of as a green indigo. Poivre, who visited Cochin China in 1749, speaks of a plant, Tsai, producing a green dyeing matter. Horta, in 1760, mentions the same as employed by the Tonquinese. The word Tsai, however, is an adjective, applied to several herbaceous and leguminous plants, and hence nothing could be distinctly known by this denomination. Charpentier de Cossigny speaks of another substance—Dinh-xang; xang or xanh signifies, in the Cochin Chinese language, green. Mr. Hedde, who visited Tooran in 1844, said that the price of such a dyeing material per kilogramme was 2s. 6d., and that it is probably collected from the *Mercurialis perennis.* It may then be concluded that Tsai and Dinh-xang were up to that time unknown materials.

Green indigo was imported into London in 1790 by Prinsep, and examined by Mr. Bancroft. This was supposed to be the Tsai of M. Poivre; but, as M. Persoz observed, it was only a mixture of chlorophyll (leaf-green) with indigo. Attempts were often made in India to produce a green material of the same composition. Kurrer speaks of it 1801; Mr. Nicholas Cézard, in 1837; it was examined by Gustavus Schwartz of the Société Industrielle de Mulhouse; and in 1856 I received a specimen from Java of the same character.

The green coloured Barasat, forwarded by Mr. C. Birch, in 1793, from Calcutta, to Messrs. T. F. Baring and Co., and examined by Bancroft, was identical in composition. It was at that time supposed to be prepared from the *Asclepias tinctoria*, Roxb., but afterwards it was acknowledged to be the Taroem akkar or indigo of Sumatra, from the *Marsdenia tinctoria*, Rob. Brown, *Pergularia tinctoria*, Spr. *Taroem* signifies at Sumatra indigo. Marsden (in the History of Sumatra, ed. 1811, p. 94) mentions it as generally employed as a blue dye in Sumatra; the plant being common in the Indian Archipelago. The plant is likewise common in Borneo, but does not grow in Java; another species, *Marsdenia parviflora*, Dec, or Taroem aroi, is cultivated there.

In his report on the Paris Industrial Exhibition of 1855, the late Dr. Royle noticed three kinds of green (indigo), one Chinese, one from the Birman empire, and one from Assam. The last was exhibited by Dr. Falconer, under the name of *Roem.* This was quite different from the Lo-kao, being a product of a sort of *Ruellia*, generally cultivated in the Birman Empire and Pegu. Lila roem is the indigo, from the *Wrightia tinctoria*, R. Br.

It is not astonishing that the name Lo-kao is pronounced and written in various ways. This is commonly the case when an Englishman, Frenchman, or Dutchman expresses a foreign term according to his own language. The Lokao of M. Rondot is Lak-kou (Carvalho), Luk-kaou (Edkins), Lau-kow (Remi), Louk-ko (at Canton), Liok-kou or Lek-ko (at Fokien), Loe-kaau (De Grys). Mistakes frequently occur, therefore, when a European communicates with the natives, and hence Mr. Forbes, when asking for the green dye, received from the Chinese the Schweinfurther green, a European product, in a Chinese bottle, with Chinese inscriptions.

The plant is called Lo-sa; that with white bark pa-bi (or pe-pi), and that with brown bark, hom-bi (or hong-pi). The Pa-bi-lo-sa, or *Rhamnus chlorophorus*, ranges from 25° to 26° N.L., and principally between 30° and 31° in the mountains of Khiu-tsjeou-foe, at the S.W. of Tsje-kiang, and at Canton, Hang-tsjeou-foe, Kia-hang-foe, and Ning-po. Fagots of it are sold at 17s. per two hundredweight, but the bark only being 50 per cent., its price is properly double of this sum. The Hong-bi-lo-sa or *Rhamnus utilis* is found from 30° to 39° N.E., also in a more temperate climate. The fagots are sold at 7s. per hundred weight, the bark costing 14s.

M. Rondot is of opinion that both plants could be acclimatised in the south of France.

It was not less difficult to decide what parts of these plants were employed. In 1852, Mr. Bourboulon, at Macao, and Mr. Carvalho, at Canton, reported to the French Minister of foreign affairs, that the flowers and foliage were used, but M. Persoz, at Paris, received some cloth dyed by the colouring matter obtained from the roots. MM. Marc Arnaudtizon, Edkins, Hélot (as usually at Azé) Aymery (as usually at Tsji-li) noticed the bark.

It appears that the fruits being small black berries, with a hard nucleus, as large as that of the hemp-plant, contain likewise a colouring matter. The Rev. Père Hélot denies this. Mr. Edkins, however, asserts that the Chinese prepare from it a green colour, and M. Remi confirms this, saying that it is specially employed for both water and oil-painting, whilst the bark serves to dye cotton cloth. Mr. Fortune noticed that the colouring matter of the fruit is used for painting on paper.

The Lo-kao (translated in our language green paste) is the sediment remaining after dyeing the cotton cloths with the bark of both plants, a thousand pieces producing only one kilogramme. A friend of M. Rondot, at Shang-hai, wrote to him that he should be able to send over 800 or 900 lb., which would be the sediment after the dyeing of a million of pieces. This, however, is not astonishing, when we consider that the colour green is that most liked by the Chinese, for in several places regular green-dyeing establishments exist in that country.

The fagots, not older than one year, are cut in small pieces, and the colour is extracted by boiling in water. At Azé, both sorts of plants are boiled and extracted in separate vats; in another vat is prepared lime-water. The cotton cloth is dyed from seven to ten times in the extract from Hom-bi-lo-sa, and then three times in the extract from Pa-bi-lo-sa. Before dyeing, a small quantity of lime-water is mixed with the liquid extract. The cloth is dyed in the afternoon, spread out in the fields during the evenings, and taken up in the morning before nine or ten o'clock, so that the cloth only undergoes the action of diffused daylight. The effect is that the upper side becomes green, the under side remaining quite colourless. When at first this characteristic appearance of the Chinese green cloth was observed in Europe, it was supposed that the colour was applied by brushes or some other mechanical means, totally unknown to the European dyer. Such was the opinion of Mr. Mercer, and M. Persoz. Since, however, M. Michel, at Lyons, had succeeded in producing a green colour by the action of sunlight alone on cloth, dyed with an indigenous evergreen sort of *Rhamnus*, M. Persoz acknowledged it to be a new, and, till now, unknown effect of sunlight in producing vegetable colours.

After spreading, the cloth is rinsed in vats with pure cold water; there are five or six arranged in a row. The water assumes a light green colour. All the wash-waters are collected in one vat, the bottom of which is covered with cotton thread. By boiling, the colouring matter is precipitated on the cotton, and the water above becomes colourless. From this cotton the colouring matter is separated by merely pressing and wringing, and then spread on blotting paper and dried. The Lo-kao then assumes the appearance of thin scales, like dried orange bark.

Persoz assumes, as a distinctive new principle or constituent of the Lo-kao, the *Cyanine*, a substance not containing nitrogen. As I before stated, the ashes contain 45 per cent. of matter soluble in hydrochloric acid; of this are 31·16 lime (Ca O), so that nearly $\frac{1}{3}$ of the ashes are lime; 13·24 per cent. ($Fe_2\ O_3$) oxide of iron, alumina and phosphoric acid, probably decomposed from the clay of the ground where the cloth has been spread. It must be remarked that the Chinese distinguish the cloth dyed with the extract of the plants, Se-lo-poe, with one coloured side, from the cloth dyed with Lo-kao, the latter being called Oe-lo-poe, coloured on both sides, as usual.

It is a characteristic of the green-dyed Chinese cloth that its colour, when moistened with concentrated hydrochloric acid, vanishes, but after some time reappears. This experiment can be repeated several times without destroying the dye. The colour is changed to purple red by the action of hydro-sulphate of ammonia; chloride of tin changes it to salmon colour. On that ground M. Persoz supposes that there is really mixed with it a yellow colour, derived from a substance resembling the Persian berry. Should this be further confirmed, it will agree with the information I have received that the Hwa-wha is used for reviving the green colour of Lo-kao in dyeing common cotton cloth.

M. Natalis Rondot says, likewise, that all his inquiries tend to show that the yellow colour of Hwa-wha, or of the Hoang-tsji, is employed to vivify the bluish green of the Lo-tsé. This explains why the Lo-kao of Soe-tsjeou-foe is more tending to blue, and that of Emoei more to yellow. The properties of the Lo-kao are, according to the description of M. Persoz, as follows:—

Lo-kao is insoluble in water, soluble in alcohol, ether, sulphide of carbon, and volatile oils. By soaking it can be intimately mixed with 25 or 30 parts of water. By heat it is decomposed without sublimation; on burning it gives a light yellow flame. Acetic acid facilitates its being dissolved, and the mineral acids, hydrochloric and sulphuric acid, have the same effect; a weak solution of tartaric acid rapidly dissolves it at ordinary temperatures. The reaction consists principally in dissolving the combinations with lime. The above-mentioned acids exercise no reducing or oxydizing action, but when concentrated or assisted by heat, they only decompose the supposed yellow constituent of the dye. Lo-kao is dissolved in concentrated hydrochloric acid, and produces a green gelatinous fluid; after some hours the coagulated part becomes grey, the liquid above being yellow. When this sediment is washed, and neutralised by ammonia, the green colour is not restored, but a blue or violet is produced.

The colour is destroyed by the oxidising acids. If exposed with caution to the action of these acids, the green colour changes first into red, and then into light rose-colour. The red colour appears equally by the action of the deoxidising acids, sulphurous acid, arsenious acid, oxalic acid, and formic acid. Hydrosulphuric acid changes the colour into blood-red; this colour vanishes as the hydrosulphuric acid becomes decomposed by the influence of the atmosphere, and then the original green colour is restored.

With concentrated sulphuric acid it forms a wine-coloured solution, which is decomposed by water. From the sediment, however, the original green substance cannot be reproduced.

The caustic alkalies appear to dissolve it, but by a long-continued action, or by boiling, the colour is changed into brown, applicable for dyeing cotton, by the aid of alum or a salt of tin. The same reaction follows when it is boiled with lime-water, or the carbonates and sulphates of the alkalies. Sulphide of ammonium has a specific reaction, changing the colour into red, as is mentioned above.

The Lo-kao, after soaking in water, becomes very soluble in warm solutions of soda or borax. These solutions can be employed to dye cotton cloth directly. Soap made with soda dissolves it very easily. A solution of soda-soap, containing from five to six parts per 1,000 of water, dissolves it, with the aid of heat, and forms a perfect dyeing-liquid for cotton.

Chloride of zinc and chloride of magnesium change the colour into pure blue, resembling indigo blue on cotton. The salts of alumina give to the colour rather a bluish tinge. The salts of tin change the colour into blood-red. This colour is the best for dyeing silk, because, after saturation with an acetic alkali-salt, and exposure to the atmosphere, the green colour re-appears. In this case, much attention is to be fixed on the degree of concentration of the salt.

In every case it is necessary, for uniform dyeing and printing by Lo-kao, that it should be freed from earthy constituents. The best way of doing this is given by M. Persoz. The soaked Lo-kao is dissolved in a concentrated solution of carbonate of potash. After having separated the sediment, the liquid is diluted, and then from this the green colouring matter will fall down. The Lo-kao can likewise be dissolved in $1\frac{1}{2}$ part of acetic acid, diluted by 5 of water; this is properly the clearing from the combination with lime. After filtration, the liquid is neutralised by ammonia, and the Lo-kao subsides in a pure state. For further details, the admirable work of M. Natalis Rondot may be consulted. I will only add that, for printing, the Lo-kao is diluted with a solution of gum, alum, acetate of alumina, &c.

It would be of great importance to ascertain whether there are any European plants containing the principles for a colouring matter resembling the Lo-kao. Since it was decided that the Chinese prepare it from two sorts of the genus *Rhamnus*, the way was opened for making experiments with European species, such as *R. alaternus*, *frangula*, *catharticus*, *hybridus*, *alpinus*. M. Michel, at Lyons, succeeded in treating cotton cloth with the extract of the *R. catharticus*, especially by spreading it at night, and taking it up every morning before sunshine, which, when repeated several times, produced a green colour on one side very much resembling the Lo-kao.

The genus *Rhamnus* was long since mentioned as producing green and yellow colours. The *vert de vessie* is prepared from the unripe fruit of *R. catharticus*; the Persian berries from *R. saxatilis*; the *grains d'avignon*, or yellow berries, from *R. infectorius*. A green or yellowish green can be dyed with the foliage of the black alder tree (*R. frangula*). It is very remarkable that the wood of the *R. alaternus* can be employed for blues; and hence appears the possibility that, by mixing it with the yellow that can be extracted from the bark of another kind of *Rhamnus*, a green colour may be procured. In that way it could be explained why the Chinese employ two different sorts of the same genus of plant. Very much, however, depends on the climate and season. In Sweden, where the *R. frangula* is employed for dyeing woollen cloth, the bark is separated from the plants and dried. The fruit of the same plant gives a yellow colour before ripening in July and August, but in September and October, after ripening, a blue-purple, green, or blue, varying with the composition employed as a mordant.

We may now conclude that the problem, how the Lo-kao is prepared, is not entirely solved, but there is no doubt that the scientific investigations made in Europe will soon supply this want. We are indebted to Mr. Natalis Rondot for having drawn the attention of European manufacturers to some other vegetable colours used by the Chinese dyer.

In the first place may be mentioned the Hoang-tsji or Wong-shi. Hoang or Wong signifies yellow, and hence it is the yellow colouring matter of the Tsji. It is called by the Germans *Chinesische gelbschoten*. It is, in fact, the berries of *Gardenia*, which appear to be capsules filled up with brown-coloured, very hard grains or seed in a yellow pulp; the yellow colouring matter is combined with the vegetable jelly of the pulp. By soaking in cold water a very pure yellow colour is produced, that can be fixed on cotton cloth without the use of a mordant. The colour is not attacked by alkalies or acids, with the exception of nitric acid.

In September, 1857, the Chamber of Commerce of Lyons bought a quantity of $22\frac{1}{2}$ kilogramme from Prof. Th. Martius, at Erlangen, paying 3s. 4d. per kilogramme. In January, 1858, M. Rondot received $2\frac{1}{2}$ kilogrammes from MM. Remy, Schmidt, and Co., at Shang-hai.

There are three sorts: the largest fruits from the *Gardenia grandiflora* (Lour). This Hoang-tsji is called by Mr. Hanbury, Tsji-tse, and is the same as that sold by Prof. Martius. It is mentioned by Kaempfer.

Another sort of better quality is in egg-shaped fruits, the *Gardenia florida* (Lour). Mr. Hanbury calls this *Sjan-tsji*. The third sort is the smallest, nearly globular. It is not determined whether it originates from *G. florida* or *radicans*. The same sorts of plants are very common in Java, where the name is *Katja-piering*, and also in the other islands of the Archipelago. In Java it is only an ornamental flower, because, owing to the high temperature, the fruit is not developed. In the higher districts like Tjipannas, at 3,400 feet above the sea, the fruit can be largely collected. The Chinese species of *Gardenia* was introduced and cultivated at Java at the same time that the culture of tea was undertaken, because the colour was employed in China for colouring the tea chests. At that time it was not generally known that the plant is a native of these islands. I hope shortly to receive the fruit from Java for a comparative examination.

At Sumatra, our celebrated botanist, Mr. Teysman, has detected another species, *G. glutinosa*, whose fruits give an equally beautiful yellow colour. Samples of this sort will be likewise forwarded for trial.

The other vegetable yellows of the Chinese are, *Hoang-tang*, probably the root of *Menispermum cocculus*, or Indian berries, or *Fibraurea tinctoria* (Lour.) *Hoang-tsji* or Safflower, from *Carthamus tinctorius*; *Hoang-pe-mou*, or bark of *Pterocarpus flavus* (Lour.) *Ti-hoang*, the root of *Rhamnesia sinensis*; *Kiang-hoang*, the root of *Curcuma longa*, the *Turmeric*; the Hwae-hwa, Hoai-hoa, Wei-fa, or the non-developed flowers of *Sophora japonica*, as already mentioned. It is sold in China at 5d. or 6d. the kilogramme. It is well-known that it is employed for dyeing green with Lo-kao, or alone for producing yellow. Mr. Meadows asserts that, by a process kept secret in the province of Canton, the Hwae-hwa is employed to dye cotton and silk green, without mixing or grounding with blue, but this requires confirmation. It was stated by Mr. Sinclair that at Emoei there exists an establishment for dyeing cotton green, but the process is unknown. At Tjang-tjsoe-foe it is said to be employed for dyeing silk green. This material is called at Canton Oee-fa; Ningpo, Wae-hoei; Emoei, Hoeae-ho. It was, in 1851, exhibited as Whi-mu.

The plants producing a blue colour are called by the Chinese Lan. Such are several sorts of the genus *Polygonuses* and the *Ruellia indigotica* of Tsje Kiang. The indigo of the southern provinces is prepared from *Isatis indigotica*. From the same genus the Woad is procured. The Dutch embassadors sent to Pekin nearly two hundred years ago, P. de Goyer, and Jacob de Keyzer, make mention of the blue dyeing with the *Tyen-wha* or *Tien-hoa* of the *Idatis*.

The indigo of the *Indigofera* bears the name of *Thoe-tien* or *Tsja-lan*.

PERIODICAL EXHIBITIONS.

The following article is extracted from the *Standard*:—

"After all the agriculturists take the lead of the manufacturers. They have their special society and their annual meeting to furnish a record of progress. The Society of Arts cannot match this. It is very good in its way, but merely scientific and artistic in character. It wants the practical stamp of a simple exponent of manufactures, and does not pretend to it. It reflects no small credit on the agricultural body that they are a pace in advance in this matter. They have an association to look to the improvements of the year, to collect them, to exhibit them, to encourage them, to reward them. The British Association for the Advancement of Science has no such advantage. Admirable as is this institute it only takes note of the more prominent improvements or experiments in physical or abstract science. The meetings have a touch of the dilettantism in them, and can scarcely be considered as practical. Now, the characteristic of the Agricultural Society is its eminent practicability. In truth, if not matter-of-fact and real, the proceedings of the association are worth nothing. A scientific plough that will not do its work will soon be discarded; and a lean bullock, though fed according to the nicest rules of cattle dietetics, would be altogether inadmissable. It is something, therefore, for the farmer to say that he alone has a Great Exhibition every year. And if he intended to boast, he could point to numerous shows which can only be regarded as offshoots from the parent society. In fact, the whole range of farming is now becoming a matter of public competition and enterprise, and has its local and class divisions rivalling one another, and in some instances eclipsing the great annual gathering. Baker-street, Birmingham, and the Crystal Palace are important exhibitions in themselves, and the auctions for sale or hire of cattle are made objects of general interest and universal commercial speculation. On these occasions we find American bidders, Australian bidders, French bidders, and German and Spanish bidders; and these for the most part the representatives of distinguished personages or great companies in their own country. Even in horticulture there is the same advance. In addition to our numerous general flower shows and floricultural societies we have associations for the improvement of the growth of roses, of dahlias, of chrysanthemums, &c. The manufacturing world, with all its vaunting, can show no such sign of enlightenment and advancement. Where are our linen shows? Our cotton shows? Our woollen shows? Or our silk shows? These, in their various departments, might be made not only attractive to the public, but highly instructive to all concerned in the trades. Then, surely the machinery in connection with them could not be exhibited without producing the very best effect on the march of invention. The field of our manufactures is comprehensive and vast; but, with the exception of a few stray lectures and casual expositions, it has no public recognition and display like those in operation within the more limited area of agriculture. Alderman Mechi as a manufacturer or tradesman was of small importance, but as the Tiptree farmer he is a foremost man. The same may be said of other gentlemen in a similar position. They had to go to the country for their honours. The great objection made by the manufacturers to exhibitions is their expense. Long-cloth cannot afford the cost which Broad-acres cheerfully incurs. Everybody knows that it is only by immense skill and exertion that any of our annual shows are made to pay. Then there is not only much private munificence, but also large private loss and sacrifice. But this is the story of our progress—we conquer through loss. All victory is made up of the same individual damage and self-denial. There are very few exhibitors at our cattle shows who are not out of pocket, and no farmer goes thither for the purpose of making money. It is rather his custom to put a few pounds in his purse, and resolve to spend it bravely on this special occasion. He has his pride of class about him, and he, too, wishes to show handsomely. Our manufacturers boast of great wealth and unlimited enterprise. We only wish, for the common good of the country, that they would just take a lesson of patriotism and liberality from these stupid Conservative farmers.

"But even with respect to the agriculturists, one naturally asks the question, is all this competition and public display for the public good? Is meat better and cheaper now than it used to be? Can the same be said of grain, fruits, and vegetables? Shall we really set to plough by steam and to farm by machinery? We answer all these questions in the affirmative. The improvement of breed must introduce a better quality of flesh; superior attention to the growth of corn, garden products, &c., must and does enhance their goodness. Whether all the classes of engines and implements experimented upon will be ultimately employed in agriculture is a wider problem. But it is one that admits of a limited answer. The nature of the trial must necessarily lead to closer calculation and observation, and therefore to improvement. Moreover, many of these new instruments are now in general use, and will in time become universal. The material and national good then is pretty apparent; but there is a vast moral advantage underlying all these exhibitions. They encourage talent and diffuse kindly fellowship and feeling among men of different classes. The prince and the peer, the engineer and the farmer, are all members. They meet together on the same ground. They frequently intermingle and shake hands in friendly conversation, and the humbler man is often the winner of the prize, being thus far the superior for the time. Then these great exhibition folk do not do all the grazing or growing work themselves. Their subordinates are the main instruments, the real operatives. In this way, *Mr.* Smith, the bailiff, or *Mr.* Jones, the gardener, is a great man, and he feels his importance and has it acknowledged ever afterwards. Even a ploughing match makes a hero of the successful clodhopper for the time, and thus raises him in self-respect and intelligence into a man. There are no composing matches among compositors, or printing matches among machinists, or weaving matches among weavers. In fact the entire manufacturing tribe ignore emulation and competition among their workmen, and stimulate them only on a sordid principle of hire. The country is far in advance of the town in all these matters and indicates a higher civilisation. It must on all hands be admitted, too, that the success of our agricultural associations greatly depend on the part the aristocracy take in them. The very order which Mr. Bright and his imitators seek to defame are the mainstays of this progressive movement in the nation. Expunge the list of peers and great landed gentry from the list of supporters and exhibitors in these societies, and you reduce them to a mere skeleton, without sinew or substance. It ought to be remembered, too, that these shows are signal peace makers. Men of all nations intermingle here in fellowship. Only war or something like it, can call them away from the friendly competition. It was a matter of remark the other day that Napoleon III. was not, as usual, represented at an auction for the hire of bulls, but at the same sale men of nearly every country were present, and gave animation to the spectacle. It is just the same with our exhibitions. We must, then, in common sense and fairness, send the peace-at-any-price men to our agricultural shows, and bid them take a leaf from the farmers' book, if they wish to exterminate war from the catalogue of human calamities. A fat ox and a ploughshare are good emblems of peace. We recommend Mr. Bright to become an active member of the Birmingham cattle show."

[The writer of the above article appears not to be aware that previously to the establishment of the Royal Agricultural Society, and at a period when no other public body was occupied with the subject, the Society of Arts devoted much attention to the progress of Agriculture, and awarded premiums for improvements in it. The early volumes of its Transactions show how much the Society laboured to promote the advancement of Agriculture.—[Ed. *S. A. J.*]

CHARRED WOOD.

Rather more than thirty years ago the amateur artistic world was surprised with one of those propositions which so constantly emanate from the active brains of ingenious men. The subject referred to is that of poker-drawing. In the hands of the able professor who brought it forward, the results obtained by its means were not only satisfactory, but showed that considerable artistic effects were capable of being produced readily by means and with materials hitherto unused by the artist. Poker-drawing, in short, became a fashionable pastime with ladies and amateur artists. The world looked at its effects and wondered; while commercial men passed it by as a thing of little value to them. Poker-drawing, burnt-wood drawing, and smoke-drawing, each had its day, and having amused for a time, was, like a child's toy, soon thrown aside and forgotten. There are, however, principles involved in each of the processes which many would do well to bear in mind, especially those whose future life may lead them into positions where, desiring to record their ideas, or to enable others to work them out, they may be unable to obtain readily the ordinary appliances used in drawing. A workman in the back woods of Australia, with a red-hot nail and a piece of wood, may record his plan for constructing some new or modified tool; or upon a bit of wood charred on its surface may, with his pocket-knife, by scraping away portions of the charred surface, execute his sketches, and record the scenes through which he passes, in a manner both easy, artistic, and durable. The object in now alluding to the above, is to call attention to the modified form in which burnt wood is at the present time introduced commercially as an article of trade. The principle of burning wood by means of dies, is not new, for the Burnt-wood Carving Company produced many beautiful works in relief; had the process, however, employed by them been an economic one, or capable of easy working, it would not have been given up after the large sums which were invested by it in the production of dies.

The modified form in which burnt wood is now again introduced, for commercial purposes, is that of charring the surface only by means of engraved cylinders, heated with gas, which enables the degree of heat to be regulated and the extent of the char to be controlled. The object is not to produce designs in relief, but in light and shadow upon a perfectly flat surface. This is now being done by Mr. Brigg, both artistically and economically. By this means he produces ornamental pannels and imitations of the more costly woods. After the surface has been charred sufficiently to yield the greatest amount of shadow required, the whole surface is rubbed or scraped down to a flat surface, which is then polished or varnished. By this means imitation-grained surfaces are obtained of great durability, and at a cost not exceeding that of grained work produced by the ordinary process of painting and varnishing. Specimens produced by this process were exhibited for a few days at the Society's Rooms, towards the close of the late Exhibition of Patented Inventions, but were received too late for insertion in the Society's Catalogue, and it may be of interest to the members to direct attention to the process.

AID TO SCIENCE-INSTRUCTION.

The following Minute has been recently passed by the Committee of Council on Education:—

"My Lords proceed to revise the Minutes which have been passed in the Science and Art Department for the encouragement of scientific instruction among the industrial classes of this country who have already received primary education.

"I. All former minutes relating to science or trade-schools, and scientific class instruction, except those referring to navigation, public lectures, and the training of teachers (as hereafter appended), are hereby cancelled, and the following regulations are substituted in their place.

"II. The Science and Art Department will hereafter assist the industrial classes of this country in supplying themselves with instruction in the rudiments of—

1. Practical and Descriptive Geometry, with Mechanical and Machine Drawing, and Building Construction;
2. Physics;
3. Chemistry;
4. Geology and Mineralogy (applied to Mining);
5. Natural History;

by augmentation grants in aid of salary to competent teachers, and by payments and prizes on successful results, and grants for apparatus, &c.

"III. Any school or science class, either existing or about to be established, and duly approved by the Science and Art Department, may apply, through its managers, for a certificated teacher, or for the certification of any teacher, in any one or more of the above-named branches of science.

"IV. Examinations for certificates of three grades of competency, to teach any of the above-named sciences, will be held annually by the Department, in the last week of November, in the metropolis, as follows:—

"Nos. 1, 2, and 5, at South Kensington.

"No. 3, at the Royal College of Chemistry, Oxford-street.

"No. 4, at the School of Mines, Jermyn-street.

"V. Annual grants, in augmentation of salaries of teachers so certified to teach in any of the above-mentioned sciences, will be given as follows:—

"For the 1st grade of competency, £20.
,, 2nd ,, ,, £15.
,, 3rd ,, ,, £10.

"Any teacher holding a certificate of competency to give primary instruction will receive, from the Science and Art Department, a sum equal to the augmentation grant which has been attached to such certificate, in addition to the grants above mentioned.

"VI. Such grants will only be made while the teacher is giving instruction in a school or science class for the industrial classes, approved by the Department.

"VII. The Department will require that suitable premises shall be found and maintained at the cost of the locality where the school or class is held; that the names of ten students shall be entered whose fees for half a year shall have been paid in advance; and that the local managers shall guarantee, for the support of the schools and teachers, from fees or local funds, a sum at least equal to the grants so long as they shall be paid. If at any time neither fees of pupils nor local funds cover the requisite amount, it must be inferred that there is no demand for instruction in the above-named sciences in that locality which the Government is justified in aiding, and the assistance of the Department will be withdrawn.

"VIII. Every school or class having a certificated teacher will be inspected and examined once a year by the department, and Queen's prizes of an honorary kind will be awarded to successful students.

"IX. Payments will be made to the teacher on each first-class Queen's prize obtained by the student, £3; on each second-class, £2; and on each third-class, £1.

"X. A grant towards the purchase of apparatus, fittings, diagrams, &c., of 50 per cent. on the cost of them, will continue to be afforded to schools and classes in Mechanics' and similar Institutions.

AMERICAN STEAM FIRE-ENGINE.

The *Scientific American* states that one of the newly-constructed locomotive steam fire-engines lately ran twenty miles on a common road. The whole weight of the engine, water, and nine passengers, was 12,000 lbs., 9,000 lbs. being the weight of the engine alone. The first three miles were made in sixteen minutes running time, and it went over a bridge 350 feet long, with a draw of 40 feet in the centre, and up a very heavy grade, making 1,000 feet in exactly one minute. The time occupied in travelling the twenty miles was two hours, grades and all included.

AN AMERICAN HOTEL.

The *New York Journal of Commerce* states that the new Fifth-avenue Hotel in New York covers sixteen "lots" of ground, is seven stories high, and has an elevation, from the cellar to the roof, of 107 feet. The front, on Fith-avenue and Broadway, is 202 feet; on Twenty-third-street, 215 feet; and on Twenty-fourth-street, 196 feet. The main entrance is on the Fifth-avenue. On the right of this is the grand stairway, opening from the hall, and on the left is the business-office. In the rear of the main floor is situated the billiard and chess-rooms on the one side, and the gentlemen's exchange and reading-room on the other. There will also be attached to the house a Parisian restaurant, not only for the guests, but as a place where other gentlemen and ladies may dine with their families or friends, genteelly and economically.

On the second floor are the public and private parlours, opening into a corridor 613 feet long, running the entire length of the building. At the end of this corridor is the grand promenade, nearly 30 feet wide, uniting with the grand dining-hall at its western extremity, and presenting, with its double rows of columns, a magnificent *tout-ensemble*. The grand dining-hall is 80 feet long, 60 feet wide, and 21 feet high, lighted with elegant chandeliers hung from a frescoed ceiling supported by Corinthian columns. Between the latter, on one side, are placed magnificent mirrors; while, between the same, on the other, are placed beautiful French buffets.

The house contains eight large public parlours, 120 private ditto, four dining and tea rooms, 420 chambers, and other rooms for servants, &c. Nearly all of the principal chambers have baths and water arrangements complete, there being fully 100 baths in all.

To facilitate communication between the several storeys, there is provided a luxurious car, or ladies' carriage, which is capable of seating ten persons, and is caused to glide from the lowest floor to the uppermost storey; this car is propelled by steam power, passes up a revolving spiral shaft near 100 feet in height, and is provided with a most efficient hydraulic device for ensuring the safety of persons within it, in case of the breaking of any of the hoisting tackle.

The whole building will be supplied with an independent gas apparatus, costing about 6,000 dollars, by which the expense of illumination, as already proved in actual service, is reduced one-half in comparison with the city charges. The gasometer for the Fifth-avenue Hotel holds 63,000 cubic feet, and will supply 3,000 burners. Iron tanks are used instead of the ordinary cisterns.

The plan of ventilation is very effectual, the heat of the furnaces being conducted into flues extending over the house, thereby creating a strong draught, and exhausting the atmospheric impurities of the various apartments.

The building is heated by steam, for which three boilers, each 22 feet in length, and nearly 5 feet in diameter, are provided. From these the steam is conducted by pipes, all over the building, condense steam being carried back to the boilers by a return flue. The boiler and gas-house occupy a distinct building wholly detached separate from the main structure.

Among other novel and curious kitchen apparatus are ten monstrous steam-kettles, each weighing nearly 1,000lbs., for boiling vegetables, &c. All the various machinery for cooking, washing, ironing, and other processes, is in a building specially constructed, and of sufficent capacity to supply the wants of 1,000 guests.

The entire cost of this establishment will exceed one million dollars.

Colonial Correspondence.

BRITISH HONDURAS.

Sir,—I forward to you a prospectus of a "Society of Arts, Agriculture, and Commerce," which we are desirous of establishing in Belize, and I shall feel obliged if you will publish it in your *Journal*.*

This society, I hope and believe, will be productive of great benefit to the colony, and will be the means, I trust, of bringing to the notice of the British public the infinite variety of its resources. It will also, I have little doubt, be instrumental in improving the minds of the colonists. We propose to have likewise a Botanical Garden, in which we shall bring together every description of tree, shrub, and plant which grows in the country. We shall place in it all the palms,—the Palma Real, or Royal Palm,—called here the mountain cabbage—the Cahoun Palm, the Super Palm, and the Cocoa-nut Palm. We shall plant in it the different kinds of cotton—the Sea Island, the Clustered Seed, and the Anguilla. We shall plant in it mahogany, cedar, logwood, pitch pine, white pine, sapodilla, Billy Webb wood, the wild cotton tree, the weed fig tree, black mangrove, red mangrove, brazilletto, fustic, calabash, iron wood, bullet tree, dogwood, ramoon, rosewood, moho, oak, axe-cuagtec, and Santa Maria. We shall grow in it the coffee tree, cacao, tobacco, sarsaparilla, ipecachuano. We shall place in it the mango, the orange, the shaddock, the forbidden fruit, the rose apple, the star apple, the pine apple, the guava, the pomegranate, the sour sop, the sweet sop, the granadilla, the tamarind, the lemon, the lime, the papaw, the melon, the Otaheite gooseberry, the mammee, the naseberry, the wild cherry, the bread fruit, the almond tree, the fig tree, and the kenepp. We shall cultivate the yam, the yampa, the plantain, the banana, Indian corn, sweet potatoes, okro, cho-cho, pumpkin, cassava, Indian kale, calslue, and the garden egg. The above are a few of the native trees, plants, and fruits of Honduras. There are many others to mention which would occupy too large a space; but all will be brought into the garden which we have in contemplation. But we do not intend to confine ourselves to those vegetable products which belong properly to this country. We shall introduce into our garden as many aliens as the climate will permit. We indulge a sanguine hope that, by means of the Society we project, by means of our museum, our reading room, our lectures, and our botanical garden, we shall elevate and refine the taste of the people, and develop the resources of the country.

The British commercial public are beginning at length to direct their attention to Honduras. The prospectus of a company, to be called "The British Honduras Company," has just been published in London. The trustee is Samuel Gurney, Esq.; the bankers, Barnett, Hoare and Co.; and the solicitors, the highly respectable firm of Messrs. Martin, Thomas, and Hollams. These names are sufficient guarantees to the public for the *bona fides* of the promoters, and the legitimacy of the undertaking. The capital of the company is to be £100,000, in 20,000 shares of £5 each. The prospectus states:—

"This company is formed under the Joint Stock Company's Act, for the purposes of cutting and importing into this country, mahogany, logwood, and other products of British Honduras; and for conducting the usual operations connected therewith; and for buying, selling, exchanging and letting lands, and affording facilities for settlers thereon."

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* See *Journal*, present Vol., p. 345.

There are two features in this proposed company to which I object.

First, the capital is far too small. Instead of £100,000, the capital ought to be a million, or £500,000, at the least. It must be borne in mind that the land, although most fertile, is, with some few exceptions, covered with forests. These must be cut down and burnt before anything can be done. For this purpose a large supply of labour will be instantly requisite. One or two thousand Indian coolies, with their wives and families, must be immediately imported. I say Indian coolies, not Chinese. I hope not one of that debased race will ever be permitted to plant his foot upon these shores. The Chinaman, in my opinion, is the very worst labourer that could be imported into the country. Granted that he is intelligent, industrious, and hardy. These qualities—no doubt very desirable—are no compensation for his beastly propensities, for his incorrigible addiction to the most horrible of vices. Besides, he would not stay in the country. After he had hoarded a little money, away he would speed to his tea-gardens, his dog-feasts, and his flat-nosed, angular-eyed, small-toed beauties. I say, their wives and families. I am convinced that no importation of labourers which does not include females as well as males, will be followed by good results. In addition to the importation of labour, there will be the purchase of working cattle, of agricultural instruments, of steam-ploughs, of boats to carry produce to the place of shipment, the erection of sugar-mills, oil-presses, cotton-gins, the wages of clerks and managers, and a thousand other incidental expenses. All these will require a very large outlay, and £100,000 would be like a drop in the bucket.

Secondly, I object to the combining with agricultural operations, the cutting of mahogany and logwood. The demand for those articles must always be very limited, and the supply must be kept a little under that demand to insure anything like a profitable return to those who are engaged in the trade. For the last ten years, the mahogany trade has not been a very remunerative business. Four large houses have been engaged in it, and two of them have failed. If it be the wish of the Company to cut up and totally destroy this trade, let them engage in it. But if they are desirous that those who are now pursuing it should prosper, and, by means of their prosperity, be able to render them valuable assistance, let them at once abandon their intention of cutting and importing mahogany. You cannot serve two masters. You cannot with success pursue agriculture and the mahogany trade at the same time. Cutting mahogany and cultivating sugar are as opposite to each other as are the north and south poles. They cannot amalgamate. The two pursuits will require different classes of labourers. To cut mahogany, you must have the big, muscular, brawny African. To till the land, you must have the light, limber, agile Hindoo. The Hindoo and the negro will never agree. If the company, then, are wise, they will, instead of cutting mahogany themselves, dispose of the growing timber to the mahogany houses which have survived the tempest, which have ridden out the storm. There is a wide enough field for them without engaging in a ruinous competition in a trade which can only be carried on, with profit, to a very limited extent. Sugar, rum, cotton, coffee, oils, tobacco, fibres, &c., will sufficiently engage their attention, and the trade in those articles cannot be pushed too far.

The sugar cultivation in Honduras is increasing, and, what, is more, is paying. During the last year, Mr. Alexander shipped to New York 80 barrels of sugar, and to New Orleans 83 barrels, amounting to about 50,000 lbs. He is now waiting for an opportunity to ship the same quantity to England. About a fortnight ago, Messrs. Guild and Co. shipped to New York 80 barrels, weighing 25,000 lbs. These facts speak for themselves.

In my reply to the letter which I received from Detroit, relating to immigration to Honduras, which you kindly published in your *Journal* of the 26th of November, the printer erroneously makes me say, "one planting of the cane will last *three* years." This is a mistake. It ought to be *twelve* years. In point of fact, in some parts of British Honduras you may go on ratooning for 15 and 16 years. In what other part of the West Indies can this be done? Nowhere. Even in Antigua, one of the most flourishing of the West India islands, they can only ratoon one year, and that only with the aid of the most expensive manure.

A specimen of cotton was brought to me a few days ago, grown by Mr. Kohr, a German gardener. It is the clustered seed cotton, and a gentleman, well acquainted with the subject, informs me that it is very superior to the cotton of the United States. When the seed of the cotton tree is planted in this country, it arrives at maturity in nine months. It then bears a crop consisting of a pound and a half of cotton; after that it will give a crop every three months, whilst the tree lasts, equally good in quality, but less in quantity. The tree, which grows to the height of nine or ten feet, continues in full bearing for three years, and gives a crop of 3lbs. in each year. Is the Manchester Chamber of Commerce indifferent to these facts? I have mentioned Mr. Kohr. Let me say a word or two about that gentleman. He came from Germany, several years ago, with Baron Bulow, to form one of the Belgian settlement of Sante Tomas. It is well known that that project failed. Mr. Kohr then came to Belize. He had not one farthing of money, but he had skill, honesty, temperate habits, health, youth, industry, and an indomitable spirit. He purchased of a gentleman, on credit, a tract of land seven miles in length, and about the same in breadth. The price was £212. In two years he paid the purchase money, which by the sweat of his brow and the labour of his hands he had extracted from the soil. A great portion of his land is now under cultivation. He supplies the Belize market with vegetables of all kinds, and the various fruits of the country, by which he makes an income of from £500 to £600 per annum. He has largely planted his estate with mango, cocoa nut, and orange trees. In eight or ten years he will have 20,000 cocoa nut trees, and 10,000 orange trees in full bearing. The annual value of a cocoa nut tree is two dollars; that of an orange tree five dollars. In ten years, then, Mr. Kohr will receive, from these two sources alone, 90,000 dollars, or £18,000 per annum! Some of your readers may think that this statement sounds very much like one of Major Longbow's astounding stories, and that it ought to have concluded with "Upon my soul it's true—what will you lay it's a lie." But without having recourse to the strong language of that ingenious narrator, or my Lord Petre's convincing arguments, to prove the truth of my story, I can assure that what I have related is a fact. If the wise Solomon had lived in Belize, he would not have said to the indolent and the sleepy-headed, "Go to the ant, thou sluggard;" but he would have said, "Go to Godfrey Kohr, the German; learn of him, and be industrious." Let the British Honduras Company turn their attention to the cultivation of cotton, sugar, oil, and tobacco, and they may depend upon it that those articles will afford them much more profitable returns than peddling and flirting with mahogany. If the company persist in combining mahogany cutting with their other operations, they will commit a grievous error. But, as the Scotch say, "He that will to Cupar maun to Cupar." I have given them my disinterested advice; there are others who from selfish motives will probably speak differently. Let me warn the company that there are men who, although they may have passed their 14th lustrum, and can shake their heads as wisely as Lord Burleigh, are yet capable of giving a fool's council. I am, &c.,

R. TEMPLE.

P. Le Neve Foster, Esq.

Home Correspondence.

ELECTRO-DEPOSITS FOR ENGRAVED COPPER-PLATES.

Sir,—I have been much interested by several letters that have recently appeared in your *Journal* on electro-deposits for engraved copper-plates, and having lately had an opportunity of comparing the results of the two processes—iron and zinc—I would offer a few remarks to show the superiority of the first process over the zinc coating. Mr. Bradbury himself tells us that the iron facing has yielded from 1,000 to 9,000 impressions. I have seen a printer's letter which gives the average of iron facing at 7,000 for a number of plates similar in size and subject to those upon which Mr. Bradbury bases his calculations in his communication to you in the last week's *Journal*, namely, Bank-note plates. I would point out to Mr. Bradbury that, between the zinc facing at one farthing per inch for small plates (cost price) and the iron deposit as per charges published by Mr. Joubert, there is not that "material difference" that he has stated, for in that scale of charges, which is now before me, two pence per inch is the price for small plates, and, considering their capabilities when prepared by Mr. Joubert of yielding four times as many impressions, at least, as can be obtained from the zinc—the maximum being stated at 2,000—I think I can show a vast discrepancy between Mr. Bradbury's calculations and the plain facts. As to nickel, I have not seen any deposit of that metal, but if, as acknowledged both by Mr. Joubert and Mr. Bradbury, there would be any danger of injury to the plate, unless "certain precautions" were adopted—suppose some mistake or omission made in applying certain preparations—in such a case as that of a large copper-plate which I saw a short time since prepared by Mr. Joubert's process, and for which the publisher had paid £5,000, who would bear the loss?—for money alone could not repair the mischief.

I submit this to Mr. Bradbury.

I am, &c.,

F. W. KIRBY, Capt. R.E.

Aug. 2nd, 1859.

Proceedings of Institutions.

Dover Museum and Philosophical Institute.—The twenty-first annual meeting of this Society took place at the Guildhall Rooms, on May 18, W. Sankey, Esq., in the chair. The report of the proceedings of the Society during the past year was read by Mr. A. Phillips, one of the secretaries. It stated that six London newspapers had been daily laid upon the table of the Reading Room during the past year, that the Library had only received an addition of five volumes, but that a monthly supply of books had been received from Messrs. Hookham, of London, and recommended that measures should be taken to increase this important branch of the Institution. There had been, in all, fifteen Lectures during the past Session, four of which were in conjunction with the Working Man's Institute. The Lectures had been well attended, and the proceeds paid the whole of the expenses. The Museum had received but few presentations, but had been visited by nearly 10,000 persons. Owing to deaths, removals from Dover, and other causes, thirty-two members had left the Society since the last annual meeting, but twenty-two had joined it, there was, therefore, a diminution of ten. The total number at present is 130. Mr. Penny, the treasurer, whose accounts had been previously audited, then presented his report of the financial state of the Society. The officers of the Institution were then all unanimously reappointed. The general meeting then resolved itself into a special one to consider the revision of the rules and regulations of the Society, according to a notice given to that effect. Mr. Phillips proceeded to read the report of the committee on that subject, and after a protracted discussion, several gentlemen having requested further time to consider the alterations and revisions proposed before adopting them, the meeting was adjourned. A vote of thanks to the chairman terminated the proceedings. The adjourned special meeting of the Society was held on the 25th of June, W. Sankey, Esq., in the chair. Mr. Phillips opened the business by reading the minutes of the last meeting, and then proceeded to read the rules of the Society with the bye-laws of the Reading-room and Library, as revised by the committee. The rules and bye-laws were approved and passed unanimously. By rule five of the revised rules, the number of Vice-Presidents of the Society being increased from two to four, it became incumbent on the meeting to elect the additional two, this having been done a vote of thanks was passed to the chairman and the meeting broke up.

To Correspondents.

Errata.—Page 598, second column, line 54, read:—"In 1838 Schweigger was no longer editor of any journal."

Page 606, second column, line 61, for "on the 13th of March," read "in the beginning of April," and in line 62, for "Opotchinin's" read "Afrosimow's."

Page 607, first column, line 8, read:—"He collected a great many precious Chinese, Thibetan, Mongolian, and other writings."

On same page and column, line 63, for "1835," read "1803.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 14th July, 1859.

58. Civil Service—Estimates—Class 2 (Corrected pages).
77. Constituencies—Return.
87. Parkhurst Prison—Return.
56. Municipal Rates and Franchise Acts—Lords Report.
42. Bills—Metropolis Gas Regulation.
49. ,, Pawnbrokers.
50. ,, Public Improvements.
51. ,, Imprisonment for Small Debts.
52. ,, Municipal Corporations.
53. ,, Dwellings for Labouring Classes (Ireland).

Delivered on 15th July, 1859.

64. East India (Army)—Return.
75. Bills of Exchange and Promissory Notes.—Return.
54. Bills—Settled Estates Act (1856)—Amendment.

Delivered on 16th and 18th July, 1859.

1. East India (Cabul and Affghanistan)—Papers.
40. Police (Scotland)—Report of the Inspector of Constabulary.
80. Cambridge University (Scholarships at St. John's College)—Two Statutes.
82. Cambridge University—Report of the Commissioners.
93. Foreign Seamen Apprentices—Returns.
79. Cambridge University (Trinity College, &c.)—Copies of Statutes
56. Bills—Cambridge University Commission.
57. ,, Universities (Scotland).
28. ,, Bankruptcy and Insolvency (Ireland) Act Amendment.

Delivered on 19th July, 1859.

66. East India (Public Works, &c.)—Return.
86. Shipowners—Copy of the Supplementary Correspondence.
88. Army (Number of Officers and Men)—Return.
89. Weighing Machines—Return.
91. East India (Salaries, &c.)—Return.

Delivered on 20th July, 1859.

81. East India (New Tariff)—Return.
84. Harbours of Refuge.—Return.
90. East India (Revenues, &c.)—Returns.
22. Chamber of London—Annual Accounts.
95. Mr. H. T. Wrenfordsley—Copy of Memorial.
97. Navy (Ships in Active Service)—Return.
51. Benefices and Ecclesiastical Patronage—Return.
59. Bill—Ecclesiastical Commission.

Indian Army, Re-organisation of—Papers.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, June 29th*, 1859.]

Dated 21st June, 1859.

1495. W. Coles Fuller, 2, Bucklersbury, Cheapside—Imp. in india-rubber shackles, and in springs for carriages, and the metal fittings connected therewith.

Dated 23rd June, 1859.

1512. G. C. Grimes, Wandsworth, Surrey—Imp. in cigar or such like lights, and in the means of producing them.

Dated 29th June, 1859.

1546. T. Wright, Middlesborough-on-Tees, Yorkshire—Imp. in the apparatus used in the manufacture of cast metal pipes and castings, termed core bars or spindles and chaplets.

Dated 5th July, 1859.

1595. C. Barlow, 89, Chancery-lane—Imp. in capstans. (A com.)
1596. A. Beaulieu, 25, Rue du Chemin de Fer, Porte de Cologne, Brussels—Imp. in crinolines, and in machinery for manufacturing springs for such and other purposes. (A com.)

Dated 6th July, 1859.

1604. C. Hagan, Tower of London—Imp. in apparatus for curing smoky chimneys, and preventing down draught.
1606. S. Lloyd, Wednesbury, Staffordshire—Imp. in the manufacture of cast steel tyres.

Dated 7th July, 1859.

1616. J. Smith, Norton-street, Cherry-square, New Radford, Nottingham—Imp. in propelling ships and other vessels.

Dated 8th July, 1859.

1634. W. N. Nicholson, Newark-on-Trent—Imp. in machines for making and collecting hay, and for cutting thistles and weeds, which improvements in whole or in part are applicable to other agricultural implements where teeth or tines are used.

Dated 9th July, 1859.

1640. W. Mac Kean, Paisley, Renfrew, Scotland—Imp. in the manufacture or treatment of farinaceous matters for the obtainment of starch and food.

Dated 12th July, 1859.

1651. J. Luis, 1B, Welbeck-street, Cavendish-square — Imitation leather. (A com.)
1655. G. White, Mansfield, Nottingham—Imp. in apparatus for counteracting the effects of collisions in railway trains.

Dated 13th July, 1859.

1657. C. S. Walker and R. Hoyle, Bury—Imp. in machinery or apparatus for promoting the consumption of smoke in steam boiler and other furnaces, and for preventing the explosion of steam boilers.
1658. A. Cooper, Birmingham—Imp. in the manufacture of the grips of swords and sword bayonets.
1659. J. S. Thomson, Kilmarnock, Ayr, N.B.—Imp. in steam engines. (A com.)
1660. W. Cotton, Loughborough, Leicestershire—Imp. in means or apparatus for connecting together or uniting looped fabrics.
1661. J. Combe, Belfast—Imp. in machinery for hackling flax and other fibrous substances.
1662. J. Taylor, Roupell-park, Streatham-hill, Surrey—Imp. in stoves and fire-places, and in the arrangement of flues connected therewith.

Dated 14th July, 1859.

1663. W. Walker, Liverpool—Imp. in the manufacture of metallic packages, and in machinery for manufacturing the same. (A com.)
1664. R. Mushet, Coleford, Gloucestershire—Imp. in the manufacture of shot and shell and other projectiles.
1665. R. Mushet, Coleford, Gloucestershire—A new or improved manufacture of certain metallic compounds or alloys.
1666. J. Atkinson, Lancaster—Imp. in fire-arms.
1667. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the manufacture of artificial fuel. (A com.)
1668. J. Morgan, Manchester—Imp. in apparatus for making candles.
1669. J. Bailey, Manchester—Imp. in machinery or apparatus for stretching woven fabrics.
1670. R. Longstaff, Mornington-road, New Cross, and A. Pullan, Fortie cottage, New Cross—Imp. in traction or locomotive engines.

Dated 15th July, 1859.

1671. C. Kingsford, Seaton, near Wingham, Kent—Imp. in the preparation of peat and charcoal for fuel, in the manufacture of coke therefrom, and in the machinery and apparatus employed for effecting the same.
1672. W. Clark and W. Williams, Manchester—Imp. in finishing woven fabrics.
1673. F. Brown, City Road, Middlesex—The preparation and manufacture of a new fibrous pulp for making paper, and for other useful purposes.
1674. R. Mushet, Coleford, Gloucestershire—New or improved methods of manufacturing a certain metallic compound or alloy.
1675. H. Grand de Chateauneuf, Paris, France—An improved coverlet called zephir-eider-down coverlet.
1676. J. P. Farrar, New York—Imp. in the treatment of iron.
1677. W. McAndrew, 57, King William-street, London, and C. W. Boyd, Sochia, Asia Minor—Imp. in treating poppies to obtain a product resembling opium therefrom.
1678. W. O. Carter, 12, South John-street, Liverpool—Imp. in machinery for sawing slate.
1679. F. Prince, 138, New Bond-street, Middlesex—An imp. in breech loading firearms.

Dated 16th July, 1859.

1680. J. Musgrave, jun., Bolton-le-Moors, Lancashire—Imp. in the construction of steam-boilers.
1681. J. Bernard, Albany, Piccadilly, Middlesex—Imp. in the construction and arrangement of hyraulic and other pumps, for forcing liquids and for obtaining pressure.
1683. C. Pottinger, Anstruther, Fife, N.B.—Imp. in machinery and apparatus for dredging or excavating, and for driving piles.
1684. H. Cunnew, Triangle, Hackney, Middlesex—Imp. in elastic bands.
1685. P. A. A. Trouttet, Dijon, France—A new moveable stopper for gaseous liquids.
1687. W. M. Smith, Northampton—The construction of fare-boxes, for the prevention of fraud on the part of drivers, conductors, &c. (A com.)
1688. M. H. Chapin, Boston, U.S.—Imp. in the manufacture of galloons, tapes, or ribbons for supporting steel or other hoops used for distending ladies' dresses.
1689. T. Carliell, Union-street, Portsea—Imp. in vent-pegs.

Dated July 18th, 1859.

1691. J. Bernard, Albany, Piccadilly, Middlesex—Imp. in the manufacture of boots and shoes, and the means employed therein.
1692. H. C. M. Cramer, Paris—Imp. in bedsteads.
1693. J. Shaw, Teignmouth—Imp. in the manufacture of artificial fuel.
1694. A. Phillips, Glasgow—Imp. in weaving carpets, and in the machinery or apparatus to be used therein, parts of which machinery or apparatus are applicable to the weaving of other fabrics.
1695. W. H. Harfield, Fenchurch-street—Imp. in apparatus employed in getting ships' anchors and in shackling chains.
1696. W. E. Newton, 66, Chancery-lane—Imp. in the method of constructing and operating batteries for generating or exciting, by chemical action, electricity for telegraphic purposes. (A com.)
1697. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of india-rubber, and other like fabrics. (A com.)

Dated 19th July, 1859.

1699. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in extracting oils from coal and other minerals. (A com.)
1700. J. Shanks, of Arbroath, Forfar, N.B.—Imp. in mowing machines.
1701. H. Parent, Roubaix, France—Imp. in or applicable to looms for weaving.

Dated 20th July, 1859.

1703. J. Erskine, Newton Stewart, N.B.—Imp. in breech-loading firearms.
1705. W. E. Gedge, Wellington-street South, Strand—Improved apparatus for the prevention of accidents in mines, to be called a mining parachute. (A com.)
1707. Right Hon. J. Earl of Caithness, Hill-street, Middlesex—Imp. in the permanent way of railways.
1709. W. E. Newton, 66, Chancery-lane—Imp. in self-acting lithographic printing machines. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, July 29th*, 1859.]

July 29th.

283. S. B. Eveleigh.
284. R. Needham.
290. G. A. Waller.
296. E. E. Allen.
304. J. Hirst and J. Hollingworth.
305. G. Leach.
357. A. Clark.
427. R. Cookson and C. W. Homer.
489. A. W. Smethurst.
745. P. P. Boll and H. Reger.
1317. R. Samuelson.

[*From Gazette August 2nd*, 1859.]

August 2nd.

309. W. Clayton and J. Goodfellow.
311. J. Petrie and T. Wrigley.
317. A. Allan.
320. R. A. Brooman.
322. G. H. Baylis and F. Robinson.
323. F. H. Maberly.
332. N. Greenhalgh, W. Shaw, and J. Mallison.
335. T. Sykes and B. C. Sykes.
347. J. Wilson.
393. G. Hadwen and J. Wadsworth.
398. S. H. Huntly.
418. R. Mushet.
443. H. Y. D. Scott.
445. P. E. Fraissinet.
442. J. H. Johnson.
458. P. A. J. Dujardin.
596. P. E. Aimont.
1143. W. S. Booth.
1431. W. Brown and S. Bathgate

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, July 29th*, 1859.]

July 26th.

1820. W. Wood and M. Smith.
1821. W. Wood and M. Smith.

[*From Gazette, August 2nd*, 1859.]

July 28th.

1809. W. E. Newton.
2060. W. Moberly.

July 30th.

1823. E. P. Chevalier.
2121. J. B. Robinson.

Journal of the Society of Arts.

FRIDAY, AUGUST 12, 1859.

PROGRAMME OF EXAMINATIONS FOR 1860.

The following is the Programme, copies of which have been already forwarded to all the Institutions in Union, and to each Local Board. Additional copies, where required, may be had on application to the Secretary of the Society of Arts, Adelphi, London, W.C.

PRELIMINARY NOTICE.

1. The primary object of the Examinations described in the following programme is to encourage, test, attest, and reward efforts made for self-improvement by adult members and students of the Mechanics Institutions, Athenæums, People's Colleges, Village Classes, and other bodies of the like character, that are in Union with the Society of Arts. Such members and students are commonly mechanics, artisans, labourers, clerks, tradesmen and farmers not in a large way of business, apprentices, sons and daughters of tradesmen and farmers, assistants in shops, and others, of various occupations, who are commonly not graduates nor undergraduates of any University, nor following, nor intending to follow, a learned profession. To all such, male and female (not being under sixteen years of age), the Examinations are open on the general conditions explained in this programme. (See Terms of admission to Examinations. See paragraphs 87 to 93.)

2. Other persons, however, of a higher grade of Society, who have enjoyed superior advantages of Education, are desirous to avail themselves of the Examinations, in order that their attainments may be tested and attested by the Society's Board of Examiners. The Council is unwilling to exclude from its Examinations any one that may derive advantage from them; and therefore notice is now given that persons not belonging to the classes of society first described as those for whom the Examinations are primarily designed, and not being less than *eighteen* years of age, may be admitted to the Examinations, and receive certificates, on the conditions set forth in the paragraphs 3, 92, and 100 of this programme.

3. No such person, however, and no certified schoolmaster or mistress, and no pupil teacher, can compete for any of the Prizes hereinafter offered by the Society of Arts.

4. The Society's Examinations were held, in 1856, at the Society's House in London; in 1857, at the Society's House and at Huddersfield; in 1858, at the 39 places, and, in 1859, at the 54 places, which are specified in the Appendix to this programme, page 23.

5.—In 1860, and thenceforth, it is proposed to hold the Examinations simultaneously throughout the United Kingdom wherever suitable arrangements can be made by the authorities of the Institutions.

6.—Bearing in mind that the Union of Institutions was formed for the purpose, not of superseding, but of promoting and supplementing, the action and self-government of those bodies, the Council of the Society of Arts invites them to assume a large share of authority and responsibility in carrying out the following scheme of

Previous } Examinations by { Local Boards.
Final } { the Society of Arts.

Local Boards.

7. The Managers of Institutions in Union with the Society of Arts, and others who may be desirous to co-operate with the Society in promoting the instruction of adults, are invited to form Local Boards. Each Local Board must consist of at least three members; and, with advantage, may be much more numerous. There must be a Secretary, and there should be a Chairman. The district for which the Board is to act should be defined; and every Institution for the promotion of the instruction of adults, within those limits, ought to be represented in the Board. It is very desirable that each Local Board should include the representatives of more Institutions than one; and that there should not be more than one Local Board in each locality. The composition of the Board must be such as to command the respect and confidence of the neighbourhood. Where gentlemen of high literary and scientific attainments are willing to serve on the Board, their service is of great value; but the necessary work of the Board may be done by any well-educated persons of high character and good sense. Where a Local Board embraces a district so large that the candidates cannot conveniently attend at one place to be examined, arrangements should be made for the Board's action by deputations in different parts of the district.

8. Every Local Board, that is intended to co-operate with the Society of Arts in carrying the scheme of Examinations into effect, should submit to the Council of the Society, on or before the 1st of January, 1860, a List of the Chairman, Secretary, and other members of the Board.

Previous Examinations by the Local Boards.

9.—The Local Boards will conduct the previous Examinations of their own Candidates, and also supervise the working of papers which the Society's Examiners will set for the Society's final Examinations.

10.—No Candidate can be admitted to the final Examination without a certificate (see Form No. 4 in Appendix) from his Local Board, that he has satisfactorily "passed" its previous Examination in the elementary subjects specified in pars. 12, 13, 14, 15, and in the special subjects in which he wishes to be examined by the Society's Examiners.

11.—The previous Examinations must be held by the Local Boards sufficiently early in the year, to allow the results to be communicated to the Council on or before the 10th of April, 1860, *i.e.*, four weeks before the 8th of May, the day fixed for the commencement of the Society's final Examinations.

12.—The previous Examinations by the Local Boards may be either wholly written, or partly oral and partly written, as each Local Board may think best. These Examinations are to test the handwriting and spelling of the Candidates, their knowledge of English grammar, composition, and the common rules of arithmetic, as well as their knowledge of those special subjects in which they seek to be examined by the Society's Examiners.

13.—Handwriting.—A bold, even round-hand, without loops, long tails, or flourishes, should be preferred.

14.—Spelling, English Grammar, and Composition. An extract from some standard English author should be set, into which errors of spelling, grammar, and punctuation should be introduced. Some faulty grammatical constructions in common use, and vulgarisms, should be submitted for correction.

15.—Arithmetic.—A knowledge of the elementary rules, including the Rule of Three, should be required.

16.—The Local Boards may, with advantage, admit to the previous Examinations, and grant suitable certificates and rewards to, persons of very humble attainments; but the "pass" to the Final Examinations should not be given to any Candidates, however meritorious, whom the Local Boards consider to have no chance of obtaining certificates from the Society's Examiners.

17.—Unreserved communications between the Society and the Local Boards will be requisite to secure to the "passes" of the various Local Boards throughout the Union such an uniformity of value as may be attainable; and it is hoped that their standard may be raised, carefully and gradually, from year to year.

Final Examination by the Society's Examiners.

18.—Forms containing the names of the "passed" Candidates, and the subjects in which the Society is to examine them, must be returned to the Council not later than the 10th of April, 1860.—(See Form No. 4 in the Appendix).

19.—The Society's Examiners will then set the requisite papers for the final Examination; and these will be forwarded to the Local Boards. The Local Boards will see, and certify to the Council, in the form which the Council will furnish (see Appendix, Form No. 7), that the papers are fairly worked by each Candidate, without copying from any other, and without books or other assistance; and will return the worked papers to the Council.

20.—The final Examination will be conducted by printed papers.

21.—The Examiners will award Certificates of three grades, but Certificates of the first grade will be awarded only to a high degree of excellence.

22.—The final Examinations will be held *simultaneously, on the days, and at the hours, specified in the Time-table for* 1860 (Appendix, Form No. 6), at those places where Local Boards are established.

23.—Judgment will then be passed by the Society's Examiners; and the Awards of Prizes and Certificates will be communicated to the parties concerned.

24.—A candidate who has obtained from the Society of Arts a certificate of the 1st class, in any subject, cannot again be examined in the same subject.

25.—A candidate who has obtained from the Society a certificate of the 2nd or 3rd class may, on the recommendation of the Local Board, be examined in the same subject, in a subsequent year, without again passing the previous examination of the Local Board, but his name must always be returned in the proper form (No. 4 in the Appendix).

26.—A candidate who, having obtained a certificate from the Society in any subject, desires to be examined in some other subject, in a subsequent year, may be "passed" by the Local Board, after examination in that subject, without re-examination in the elementary subjects, specified in paragraphs 12, 13, 14, 15.

27.—The following is the list of subjects for the Final Examinations in 1860:—

I. Arithmetic.
II. Bookkeeping, by Double Entry.
III. Algebra.
IV. Geometry.
V. Mensuration.
VI. Trigonometry.
VII. Conic Sections.
VIII. Navigation and Nautical Astronomy.
IX. Principles of Mechanics.
X. Practical Mechanics.
XI. Magnetism, Electricity, and Heat.
XII. Astronomy.
XIII. Chemistry.
XIV. Animal Physiology.
XV. Botany.
XVI. Agriculture.
XVII. Political and Social Economy.
XVIII. Geography.
XIX. English History.
XX. English Literature.
XXI. Logic.
XXII. Latin and Roman History.
XXIII. French.
XXIV. German.
XXV. Theory of Music.

28.—Drawing has been withdrawn from the list of subjects, not because the Council considers that Drawing is unimportant—for everyone ought to be able to draw—but because the Government has provided, in all parts of the kingdom, for the Annual Examination of Candidates in Drawing; and the Council thinks that it would be a waste of resources for the Society of Arts to follow in the steps of the Government with similar proceedings. An account of the Government Examinations in Drawing is given in the Appendix, page 12.

29.—To indicate the portions of the subjects that will be taken in the Examinations, the Examiners in the several departments have set down certain Text-books. But they desire it to be distinctly understood that in so doing they do not pronounce any opinion as to the comparative merit of the works named. The selection is in many cases determined by the cheapness of the book, or by its being in common use. Real knowledge, however or wherever acquired, will be accepted by the Examiners of the Society of Arts.

I.—Arithmetic.

30. Practice—Proportion, Simple and Compound—Greatest Common Measure—Fractions, Vulgar and Decimal—Interest, Discount, and Insurance. The principles of a Decimal Notation in money on the basis of the pound unit.

31.—The Examiners will take into account not only the correctness of the answers, but the excellence of the methods by which they are worked out, and the clearness and neatness of the *working* (which must always be shown). Round, compact figures, as nearly like as possible to old-fashioned printed numerals, will be preferred.

32. Text Books:—Any of the Modern Treatises on Arithmetic, such as Hunter's Text Book (*National Society*), Colenso (*Longmans*), or Barnard Smith (*Bell and Daldy*).

II.—Book-keeping by Double Entry.

33. Candidates should be prepared to answer questions as to the nature and use of the different books usually kept in a merchant's office. They should be prepared to journalise a series of transactions from a waste book, and, having posted the entries to the ledger, to balance the accounts, to prove them by a trial-balance, and finally to exhibit an account of profit and loss, with a balance-sheet.

34. Candidates should be prepared to draw the usual commercial forms, such as receipts, bills of exchange, promissory notes, invoices, account sales, accounts current, bills of parcels, and to explain the meanings of technical terms used in general business.

35. Text Books:—Book-keeping, Irish School Series. (*Groombridge.*)

Rudimentary Book-keeping. (*Weale's Series.*)

Kelly's Elements of Book-keeping. (*Simpkins and Co.*)

III.—Algebra.

36. Algebraical Fractions, Square and Cube Root, Greatest Common Measure, Least Common Multiple, Simple and Quadratic Equations single and simultaneous, Ratio, and Variation. Candidates should be prepared to give explanations of Elementary Principles and proofs of Fundamental Propositions.

37. Text Books:—Colenso's Algebra (*Longmans*), or Barnard Smith's Algebra (*Bell and Daldy*).

IV.—Geometry.

38. A facility in solving geometrical theorems and problems, deducible from the first six books of Euclid, will be expected on the part of those who desire to obtain certificates of the first or second class.

39. Text Book:—Euclid, Books I., II., III., IV., VI., XI., and XII. Potts' smaller edition. (*Parker.*)

V.—Mensuration.

40. The calculation in numbers of the areas and circumferences of plane figures bounded by arcs of circles or right lines. The superficial and solid contents of cones, cylinders, and spheres, &c.

41. Candidates will be expected to be familiar with the different rules of measuring and estimating artificer's work, such as joiner's, bricklayer's, mason's, slater's, and plumber's work, and to be able to prepare estimates of such work from given quantities.

42. Text Books:—Tate's Mensuration. Young's Treatise on Mensuration. (*Simms and M'Intyre.*)

VI.—TRIGONOMETRY.

43. In Plane Trigonometry, the formulæ for the trigonometrical functions of the sum of two angles, the numerical solution of plane triangles, and the use of logarithmic tables, &c.

44. Spherical Trigonometry, Napier's Rules, Solution of Spherical Triangles.

45. Text Books:—Snowball's Trigonometry, (*Macmillan*, Cambridge,) Hall's Trigonometry for Schools, (*Christian Knowledge Society*,) or any of the modern treatises on Algebraical Trigonometry. Mathematical Tables (*Chambers' Series*).

VII.—CONIC SECTIONS.

46. The properties of the three curves treated geometrically; also as deduced from the cone. The principles of projection, orthogonal and central, applied to derive the properties of the Conic Sections from those of the circle.

47. Analytical Conics, including the equations of the straight line, the circle, the three conic sections, and the general equation of the second degree.

48. Text Books:—Puckle's Conic Sections (*Macmillan*). Todhunter's Conic Sections (*Macmillan*). Salmon's Conic Sections (*Longmans*). Drew's Conic Sections (*Macmillan*). Whewell's Conic Sections, (*Parker*).

VIII.—NAVIGATION AND NAUTICAL ASTRONOMY.

49. A good knowledge of Plane and Spherical Trigonometry, of the definitions and terms used in Nautical Astronomy, and of the various measurements of time and their mutual conversions will be required, as well as skill in the use of logarithmic tables, and neatness, order, and accuracy in the numerical solutions of problems. The candidate should understand the construction of charts; the nature and laws of circular storms; great circle sailing, &c.; the methods of determining the latitude, longitude, variation of the compass, and error and rate of a chronometer by astronomical observations, with the demonstrations of the formulæ employed; the use of Nautical Astronomical Instruments, &c.

50. Text Books:—The Nautical Almanac. (*Murray.*) Riddle's Navigation and Nautical Astronomy. (*Law*, Essex-street.)

IX.—PRINCIPLES OF MECHANICS.

51. The properties of matter, solid, fluid, and gaseous.

Statics: The composition, resolution, and equilibrium of pressures acting on a material particle; constrained particles; machines; attractions.

Dynamics: Gravitation; collision; constrained motions; projectiles; oscillations.

Rigid Dynamics: Motion of a rigid body about a point;—of a free rigid body;—of a system of rigid bodies.

Hydrostatics: Pressures of fluids; equilibrium of floating bodies; specific gravity; elastic fluids; machines; temperature and heat; steam; evaporation.

Hydrodynamics: Motion and resistance of fluids in tubes, &c.; waves and tides.

Pneumatics: Mechanical properties of the air; the barometer.

52. Text books:

Wood's or Todhunter's Mechanics.

Goodwin's Mathematics.

Miller's, Phear's, or Webster's Hydrostatics.

Webster's Theory of Fluids.

Orr's Circle of the Sciences.

Golding Bird's Elements of Natural Philosophy by C. Brooke. (*Churchill*).

Lardner's Handbooks on Natural Philosophy.

X.—PRACTICAL MECHANICS.

53. The Application of the Principles of Mechanism to Simple Machines. The Steam Engine.

54. Text Books:—Lardner on the Steam Engine. Nasmyth's Elements of Mechanism, with Remarks on Tools and Machinery. (*Weale.*)

XI.—MAGNETISM, ELECTRICITY, AND HEAT.

55. The Properties of Magnets; Terrestrial Magnetism; Diamagnetism. Statical or Franklinic Electricity; Voltaic Electricity; Electrodynamics; Thermo-Electricity; the Electric Telegraph.

Conduction, Convection, and Radiation of Heat; Instruments for Measuring Heat; Specific and Latent Heat; Diathermancy.

56. Text Books:—Lardner's Handbooks of Natural Philosophy. (*Walton and Maberly.*)

Golding Bird's Elements of Natural Philosophy, by C. Brooke. (*Churchill.*)

Herschel's Discourse on the Study of Natural Philosophy (*Longmans*) for a *general* view of the subject.

XII.—ASTRONOMY.

57. The principles of Plane Astronomy.

58. Text Books:—Herschel's Astronomy. (*Longmans.*) First chapters.

Airy's Lectures on Astronomy.

XIII.—CHEMISTRY.

59. Physical. Elementary laws of heat, light, and electricity, in connection with chemical action.

Inorganic. Chemistry of the metalloids and metals, laws of combining proportions, volumes of gases, vapours, &c.

Organic. Composition, properties and decompositions of alcohols, acids, &c.

60. Candidates are expected to be able to explain decompositions by the use of symbols. Questions illustrative of general principles will be selected from the following amongst other trades and manufactures: Metallurgy of Lead, Iron, and Copper; Bleaching, Dyeing, Soap-boiling, Tanning; the manufacture of Coal-Gas, Sulphuric Acid, &c.

61. Text Books:—Fownes' Manual of Elementary Chemistry. Miller's Elements of Chemistry.

XIV.—ANIMAL PHYSIOLOGY.

62. The general principles of Animal Physiology. Practical Application of them to health and the wants of daily life.

63. Text Books:—Carpenter's Animal Physiology, 1859. (*Bohn.*)

Lardner's Animal Physics. (*Walton and Maberly.*)

Translation of Milne-Edward's Manual of Zoology. (*Renshaw.*)

XV.—BOTANY.

64. Scientific and Applied Botany. The leading principles of Morphology, Vegetable Physiology, and the Classification of Plants. The Examination will include the characters of important Natural Orders represented in the British Flora; and of indigenous commonly cultivated plants, having noxious or useful properties; also definitions of terms used in descriptive botany.

65. Text Books:—Lindley's School Botany. (*Longmans.*)

Henfrey's Rudiments of Botany. (*Van Voorst.*)

Henfrey's Elementary Course of Botany. (*Van Voorst.*)

XVI.—AGRICULTURE.

66. The theory of agriculture, and such a general knowledge of farm practice, and of the management of live stock, as must, to some extent, have been obtained in the field. The Examination in the theory of agriculture will include both the mechanical and the chemical aspects of the subject; on the one side the advantages and results of tillage operations, and on the other the influence and the operation of particular manures and foods. The questions in farm practice will test a knowledge of the cultivation of our most important crops, and of the management of our principal domesticated animals.

67. Text Books:—Lowe's Elements of Practical Agriculture. (*Longmans.*)

Johnston's Agricultural Chemistry. (*Blackwood and Sons.*)

Morton's Cyclopædia of Agriculture. (*Blackie and Son.*)

Stephens' Book of the Farm. (*Blackwood and Sons.*)

XVII.—Political and Social Economy.

68. Text Books:—Elements of Political Economy, by James Mill. Principles of Political Economy, by John Stuart Mill.

The Phenomena of Industrial Life. Edited by the Dean of Hereford. (*Groombridge.*)

Whateley's Lectures on Political Economy. (*Parker.*)

69. Some knowledge of the Commercial, Financial, and Statistical History of the United Kingdom will be required, for which "Porter's Progress of the Nation," and "Maculloch's Commercial Dictionary" may be consulted.

N.B.—The Principles of Political Economy, by John Stuart Mill, need be studied only by those who aspire to a first-class Certificate.

XVIII.—Geography.

70. All candidates will be expected to possess a sound knowledge of Elementary Geography, both physical and descriptive. Such knowledge will of necessity embrace an acquaintance with at least the outlines of the great natural features of the globe, the political divisions of countries, and the localities of towns and other places of importance. This kind of knowledge will be looked for in fuller extent with regard to the British Islands, and the various portions of the British Empire, than in respect of other countries. Among the tests applied to it, will be the requirement of the candidate to make, from memory, a sketch, showing the chief features of any particular country in Europe named by the Examiner, and also to sketch a map of the county in which the candidate may be resident. It will of course not be expected that such sketches should exhibit accuracy of detail, but they should at least show the general direction of coast-lines, mountain-chains, or river-courses, with the localities and names of the principal towns. The map of any particular county should embody the chief natural features which the district may include (with the situation of coal-fields, if any), and should have marked upon it any localities which are distinguished as seats of manufacturing or commercial industry.

In addition to the above, candidates who aim at the highest class of certificate should be prepared to answer questions bearing upon Geography in its relation to the Physical Sciences and the History of Mankind—such questions, that is, as involve a general acquaintance with the subject of Climate, the laws of Meteorology, the Distribution of Plants and Animals over the Globe, the leading outlines of Geology, the Ethnographic Division of the Human race, and the commercial resources of different lands. This kind of knowledge is looked for, not in place of geographical knowledge of a more elementary kind, but as supplementary to the latter, and throughout based upon it.

71. Text Books:—

Manual of Geography, by William Hughes. (*Longman and Co.*)

Manual of British Geography, by William Hughes. (*Longman and Co.*)

Guyot's Earth and Man. (*Parker and Son.*)

Mrs. Somerville's Physical Geography. (*Murray.*)

Physical Geography of the Sea, by Maury. (*Philip & Son.*)

Page's Introductory Text Book of Geology. (*Blackwood.*)

The General Atlas (*published by the National Society.*)

The School Physical Atlas (*either Johnstone's, or that published by the National Society*).

Maps illustrating British Geography (*published by the National Society*).

XIX.—English History.

72. A general knowledge of the outlines of English History. A special knowledge of English History from the Conquest to the end of the reign of Stephen.

73. Text Books:—Hallam's Middle Ages, chapter viii. (*Murray.*)

Creasy's Rise and Progress of the English Constitution. (*Bentley.*)

The Student's Hume. (*Murray*).

XX.—English Literature.

74. Any two, but not more than two, of the authors in the following list may be taken up for examination:—

Spenser. Faerie Queen, Book 1.

Shakspeare. Julius Cæsar, Henry V., Midsummer Night's Dream.

Milton. Comus, Samson Agonistes, Lycidas, L'Allegro, Il Penseroso, Christmas Hymn, and Sonnets.

Bacon. Advancement of Learning, Book I.

Helps. Essays written in the Intervals of Business.

Wordsworth. The Excursion.

75. Or one of the following works may be taken, with one of the above mentioned authors:—

Craik's History of the English Language.

Trench on the Study of Words.

76. Candidates are recommended to make a very careful study of the text of the authors they may select. The questions on each author will be divided into two sections, the first intended to test the candidate's acquaintance with the text, the second his knowledge of the subject-matter and his critical and literary information. Full marks will not be given for answers to the second section, if those to the first section do not prove satisfactory.

XXI.—Logic.

77. Candidates will be expected to answer questions on the different processes of thought, and on the connexion of thought and language; to analyse examples of reasoning on various subjects, and to detect fallacies.

78. Text books: Whateley's Elements of Logic; Thomson's Outline of the Laws of Thought.

XXII.—Latin and Roman History.

79. Livy, Book ii.

Virgil. Æneid, Book vi.

Roman History to the death of Augustus Cæsar.

80. Text Book:—Liddell's History of Rome (in one volume).

XXIII.—French.

81. The Examination paper will be divided into three parts.

The first will comprise questions on any portion of the French Grammar (to be answered in French, if possible), and an extract from a contemporary French writer to be translated into English. Candidates, in order to obtain a 3rd class certificate, should do full justice to this first part.

The second part will comprise an English extract to be translated into French, and a list of idiomatic expressions to be rendered from French into English, or *vice versâ*. This should be done satisfactorily by the candidate who aims at a 2nd class certificate.

In the third part, candidates for the 1st class certificate will have, in addition to the above, to answer properly some *elementary* questions on the three following subjects:

1. French literature from 1830 to 1848.
2. French Weights and Measures, as compared with the English.
3. The Religious Wars in France in the 16th century.

82. Text Book:—Michelet's *Réforme* (volume viii. of his *Histoire de France*).

XXIV.—German.

83. Schiller's Geschichte des Dreissigjährigen Krieges.

Schiller's Gedichte.

Göthe's Egmont.

Kohlrausch's Deutsche Geschichte.

Pieces from each of the above works will be given for translation. Every candidate must translate one piece. First-class certificates will be given to those only who translate well from English, and write in German a good essay relating to German history since the Reformation.

XXV.—Theory of Music.

84. Notation, the modern modes, intervals, time signatures, the stave, transposition, modulation, terms and characters in common use.

85. The Elements of Harmony.

86. Arrangements must be made, in the Previous Examination by the Local Boards, to test Candidates, by oral examination, in their knowledge or appreciation of the *sound* of musical successions and combinations. A form of the test to be used for this purpose by the Local Board at the Previous Examination will be sent by the Council to such Local Boards as may apply for it, in due time before the Examination.

TERMS OF ADMISSION TO THE EXAMINATIONS.

87. Every Candidate for Examination must be "passed" by a Local Board; and (except in the cases provided for in pars. 89, 90, and 92) must be a member of, or student of a class in, an Institution in union with the Society of Arts.

88. Institutions in Union with the Society of Arts may present any of their members or students, above the age of 16, as Candidates for Examination, through the Local Boards, without the payment of any Examination fee.

89. Provincial Unions in Union with the Society of Arts may present as Candidates for Examination, through the Local Boards, on payment to the Society of Arts of an Examination fee of 2s. 6d. by each Candidate, any persons, above the age of 16, who may be members of any Institution not in direct union with the Society of Arts, but in union with such Provincial Unions, provided that the Institution has less than 75 members, or an income of less than £75 a year.

90. Local Boards, that do not exercise the privilege described in this paragraph, need make No Payment to the Society of Arts; but Local Boards paying one Guinea a Year to the Society of Arts may admit as Candidates for Examination on payment of the Examination fee of 2s. 6d. by each Candidate, any persons, above the age of 16, who reside, within the limits of such Boards, at any place where there is no Institution in union with the Society of Arts, and no Institution at all, having either 75 members, or an annual income of £75.

91. The whole of the Candidates referred to in the three last preceding paragraphs are understood to belong to those classes which, in the preliminary notice prefixed to this programme, are described as being the classes for whose benefit the Examinations of the Society of Arts are primarily designed.

92. Local Boards may also admit as Candidates for Examination any persons, above 18 years of age, who do not belong to the classes last referred to, on payment to the to the Society of Arts of an Examination fee of 10s. 6d. by each Candidate.

93. It will be seen that provision is made whereby any member of an Institution, any student of a class in an Institution, or in an evening school, or any isolated pupil, or self-nstructing student, or any other person, of the required ages, in any part of the United Kingdom, may be admitted to the Society's Examinations.

PRIZES FOR 1860.

94. The following Prizes are offered to the Candidates, viz.:

One First Prize of £5, and one Second Prize of £3, in each of the twenty-five subjects of Examination.

95. No Prize in any subject will be awarded to a Candidate who does not obtain a Certificate of the first class therein.

96. The Prize will be given in money or in books, at the option of the Candidate.

97. The following Prizes are offered to the Institutions, viz.:—

To the Institution whose Candidate obtains the above-mentioned First Prize of £5 in any of the 25 Subjects, one Prize of £5. An Institution can take more than one such Prize: but no such Prize can be taken by an Institution unless the Council of the Society of Arts are satisfied that the Candidate, in respect of whom the Prize is claimed, has received in a class at the Institution systematic instruction in the subject for a period of not less than three months.

98. The following Prizes are offered to the Local Boards, viz.:

To the Local Board whose Candidates (not fewer than twenty) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £10.

To the Local Board whose Candidates (not fewer than sixteen) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £8.

To the Local Boards whose Candidates (not fewer than twelve) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £6.

To the Local Board whose Candidates (not fewer than eight) obtaining Certificates bear the largest proportion (not less than three-fourths) to its whole number of Candidates;—One Prize of £4.

99. No Local Board can receive more than one of these Prizes. These sums may be applied by the Local Boards to the payment of the expenses of the Examination, or otherwise, as the Board may deem best for the promotion of the objects for which it was instituted.

100. No Prize of any kind can be awarded to, or in respect of, any of the persons referred to in the second and third paragraphs of the Preliminary Notice.

APPENDIX.*

Time Table for 1860.

No Candidate may work more than one paper in each evening.

Tuesday, the 8th May. From 6 to 9 p.m.	Wednesday, the 9th May. From 6 to 9 p.m.	Thursday, the 10th May. From 6 to 9 p.m.	Friday, the 11th May. From 6 to 9 p.m.
Arithmetic. Trigonometry. Magnetism, Electricity, and Heat. Agriculture. English History.	Book-keeping. Navigation and Nautical Astronomy. Conic Sections. Chemistry. [a]English Literature. Music.	Algebra. Practical Mechanics. Astronomy. Physiology. Political Economy. French.	Geometry, Mensuration. Principles of Mechanics. Botany. Geography. German. Latin. Logic.

[a] Two Papers of one hour and a half each in this subject are considered as one.

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* In addition to the Time Table, the appendix contains the forms which will be forwarded at the proper time to the Local Boards, but as these are very similar to those of last year they are not now reprinted in the *Journal*. The tables shewing the results of the Examination have already appeared in the *Journal*, pages 548, 9, 50. The forms and tables appear, however, in full in the separate copies of the Programme, which are printed for distribution.

THE GREAT EASTERN STEAM SHIP.

On Monday last a banquet was given by the Directors of the Great Ship Company on board this vessel, which is now fast approaching completion, and which is expected to make her first trip early in September next. A large party of near five hundred persons was entertained on board, under the presidency of the Chairman of the company, Mr. Campbell. Steam was got up, and the company had the gratification of witnessing the first introduction of steam into her enormous engines. Her trial trip will be from this country to America, but it must be understood that so short a voyage is no test of her powers. It is for long voyages that her special qualities are valuable. It is expected that she will make the voyage to India in from 32 to 36 days; to Australia, in a proportionately longer time, in each case carrying coals sufficient for the voyage out and home.

The dimensions and particulars of the ship are as follow:—

Length between perpendiculars	680 ft.
Length over all	695 ft.
Length of beam	83 ft.
Length over paddleboxes	120 ft.
Height from bottom of ship to top of iron of upper deck	58 ft.
Diameter of paddle wheels	56 ft.
Diameter of screw propeller	24 ft.
Number of blades to ditto	4
Draft of ship when laden and ready for sea ...	30 ft.
Paddle engines' nominal horse power ...	1,200
Screw engines' ditto.	1,800
Diameter of screw engine cylinders	84 in.
Diameter of paddle engines ditto	74 in.
Length of stroke to paddle engines	14 ft.
Ditto of screw engines	4 ft.
Total number of boilers	10
Weight of iron in the hull of ship	7,000 tns.
Weight of ship with machinery, coals and cargo,	26,000 tns.

She carries six masts, three square-rigged, and three rigged fore and aft. The three centre square-rigged masts are of iron. Each is made of hollow wrought iron in eight-feet lengths, strengthened inside by diaphragms of the same material. Between the joints, as they were bolted together, was placed a pad of vulcanised indiarubber, which gives a spring and buoyancy to the whole spar greater than wood, while at the same time all the strength of the iron is retained. The breaking strain of the six shrouds to each of these masts is over 300 tons, which gives ample security for the masts being properly supported, as the weight of each is only 22 tons. On deck are four small steam winches or engines, each of which works a pair of cranes on both sides of the vessel. And the value of the invention may be estimated when it is expected that with these four double cranes alone 5,000 tons of coal can be hoisted into the vessel in 24 hours. The paddle engines are by Mr. J. Scott Russell, the screw-engines by Boulton and Watt. The paddle engines consist of four oscillating cylinders, of 74 inches diameter and 14 feet stroke; each pair of cylinders, with its crank, condenser, and air pump, forms in itself a complete and separate engine, capable of easy disconnexion from the other three, so that the whole is a combination of four engines. A friction clutch connecting the two cranks is the means by which the engines are connected or disconnected. The paddle engines work up to an indicated power of 3,000 horses of 33,000lb., when working 11 strokes per minute with steam in the boiler at 15lb., the expansion valve cutting off at one-third of the stroke. All the parts, however, are so constructed that they will work smoothly either at eight strokes per minute at 25lb. without expansion (beyond what is unavoidably effected in the slides), or at 16 strokes a minute with the expansion valve cutting off at one quarter of the stroke. Under the latter circumstances the paddle engines alone would give an indicated power of 5,000 horses. The boilers are immensely strong, and have been tested to double the pressure they are required to bear. Their weight, including donkey engine, pumps, funnels, &c., is 210 tons, and they are capable of containing 156 tons of water. Each set has about 8,000 square feet of tube surface, exclusive of flue or furnace, and about 400 square feet of fire-bar surface. Each is equal to supply freely with moderate firing steam for an indicated horse power of 1,800 when working with 15lb., but with full firing can supply an indicated horse power of 2,500. The fireplaces and ash pits are fitted so as to be well adapted for the use of anthracite coal.

The screw engines are constructed on the same improved principles. They have four cylinders of 84 inches diameter and 4 feet stroke. The cylinders are capable of being worked together or separately. When working 45 strokes a minute, with steam on at 15lb. and cutting off at one-third of the stroke, these engines give an indicated power of 4,400 horses, but at 55 strokes a minute, steam on at 25lb., and cutting off at one-quarter of the stroke, the power will reach to 6,500 horses. Thus the united efforts of both screw and paddle engines will drive the immense vessel through the water with a power of no less than 12,000 horses, and at a speed which is calculated at from 22 to 23 miles per hour. The screw engine boilers are in three distinct sets. Their weight is 362 tons, and their capacity for water 270 tons. The probable consumption of coal when both engines are at full work will average 250 tons per day. The cellular compartments at the bottom of the ship will be used for pumping water into instead of ballast, and as the webs subdividing these are perfectly water tight, any one or any number can be filled at pleasure.

The importance of this gigantic undertaking cannot be overestimated; if the ship be successful, and the Company are most sanguine that she must be, both commercially and mechanically, she will not long be without followers. She has been about five years in building. That she has been built is due to the commercial enterprise of Mr. Campbell, Mr. Jackson, and other capitalists, who had confidence in the skill, energy, and ability of Mr. Brunel (the originator of the idea), and of Mr. J. Scott Russell, to whom has been entrusted the planning, building, and construction of the ship, and to the indomitable perseverance, industry, and business habits of Mr. John Yates, who was Secretary of the original Company from the commencement, until the vessel lately passed into the hands of the Company to which she now belongs.

In connection with this subject, and the great growing importance of steam in the commercial navy, the following article is extracted from the *China Telegraph*:—

"In the recent agitation by the British shipowners, on the alleged depression of British shipping, one very important feature and influencing cause was entirely overlooked, or purposely kept out of sight; and yet it forms a leading element in the inquiry as to the present position of our mercantile marine. The great shipowners who took so prominent a part in the movement, clinging to antiquated notions and the fashions of the good old times, ignored altogether the progress and influence which steam has exercised on the carrying trade of the world. For aught that transpired then, the world would have supposed there was no such thing as a steamer afloat; or that the commerce of the globe had in nowise benefitted by the immense steam fleet now in movement, and by which we hold the principal ocean traffic. Those who still cling to the heavy goods train, while the express lines of paddle and screw are traversing every sea, must, like the canal-owners and stage-coaches, expect to be distanced in the race.

The strides which the British steam marine has made in the last few years are so gigantic, and probably so little appreciated by the public at large, that it may be well to take a survey of the figures, for present comparison and future reference.

Fifty years have not elapsed since the whole steam navigation of the British Empire was concentrated in the little *Comet*, a vessel of forty feet keel, and ten and a-half feet beam; and now the steam-fleets of Britain—many of the ships being floating palaces—are sweeping all seas, and connecting the ends of the earth, for the purposes of mutual benefit. We have gone on gradually enlarging and improving our build of steamers, until we have now afloat—if not yet at sea—a vessel of 680 feet keel, 83 feet beam, of 23,000 tons burden, and capable of being worked up to 10,000 horse-power. The sky of every navigable stream and inland lake is now darkened with the smoke of the steamers. Local coasting, and river steam companies, are now to be found throughout the world. Commencing at the antipodes, our Australian colonies possess a very respectable mercantile steam fleet. Steamers run between the New Zealand islands and the Australian ports; between Tasmania, Port Phillip, Sydney, and Port Adelaide. Steamers navigate the Hunter's River, the Illawarra, the Murray and its tributaries, the Darling, and Murrumbidgee. Steamers communicate with Singapore, and the islands of the Eastern Archipelago, and are met with in the Chinese ports, and on the Canton, Yellow, and Amoor rivers. In British India, steamers now traverse the Irrawaddy, the Gangés, the Jumna, the Indus and its tributaries, and the navigation of others gradually being opened up by steam. The Indian ocean and the Red Sea have become steam highways. The Mauritius and Ceylon now own local steamers. Even African commerce in the far interior is at the present moment subserved by steam, for steamers are found on the waters of the Orange River, the Zambeze, and the Niger, as well as at all the leading ports on the western coast, and on the south eastern shore, from Table Bay to Natal. In South America steamers now run on the Paraguay, the Amazon, the Magdalena, and some other rivers; while, proceeding nothwards, almost every available lake and river is turned into a channel of commerceby steam power. Nicaragua to the Canadian lakes, and thence to California and British Columbia; the St. Lawrence, the Ottawa, the St. John, and even some of the rivers of the Hudson's Bay territory, are now navigated by British steamers. We need not go into detail here as to the progress the Americans have made in steam on their inland waters. Their vessels are of a different class, and though well adapted for the purposes intended, not to be compared for build, durability, and general construction, with British built steamers. The Panama route to Australia has been repeatedly pressed upon public notice here and in the colonies, but British shipowners have perseveringly refused to attempt it. Forced on, however, by the colonial grants made by the Sydney and other legislatures, the Home Government at last has invited tenders for the mail service across the Pacific, which will, we trust, lead to an early fortnightly communication with Australia, and to a closer steam connection with Japan and China, and the Eastern Archipelago. The value and importance of regular steam communication with our colonies and foreign countries, even with the heavy annual subsidies paid, and the extraordinary impetus it has given to commerce, are too well understood and appreciated to require enlarging on.

The introduction of screw propulsion in 1839 soon directed attention to that system for merchant vessels, and the progress was so rapid, that in 1854 there were more than 200 commercial screw ships registered in the United Kingdom. England using now steam-power on the ocean more extensively than other countries, suffers less from the derangement of commerce than they do. The increase of screw-steamers, and their general employment on voyages of short extent, or where coaling facilities can be secured, has made a rapid revolution in the nature of our shipping, and contributed to keep down the prices, and to depress British sailing-vessels. Steam, which has long held the monopoly of the mails, light goods, and the chief part of the passenger traffic, is now engrossing a large share also of the merchandise transport from the United States, from South America, from Africa, and even from India. We cannot but express our astonishment that screw-steamers are not yet established for the conveyance of tea and silk from China. If the merchants and shippers find steamers to be more speedy, regular, and certain, it is but natural that they will have the preference over sailing-vessels, even at a slightly enhanced charge for freight. The great demand for steamers of a large size for ocean and river navigation, coupled with the application of the screw, and the adaptation of iron for the hulls, has almost transferred the construction of steamboats from the hands of the shipwright to those of the hammerman and the engineer. By far the largest proportion of steamers now built are constructed of iron, and a considerable number of sailing vessels are also built of iron. Of 247 steam-vessels built in the Clyde during the seven years anterior to 1853, 14 were of wooden hulls, and 233 of iron. The aggregate burthen of the wooden steamers amounted to 18,331 tons, that of the iron to 129,273. In 1857, there were 155 steam-vessels, of 49,940 tons, built of iron, out of 228 vessels and 52,918 tons constructed in that year; and there were also 38 sailing ships, of 13,351 tons, built of iron. But we not only build for ourselves, we also supply steamers for foreigners. In 1855, we built 45 steamers, of 25,854 tons, for foreigners; in 1856, 69 of 32,976 tons; and in 1857, 93 of 34,676 tons. Celerity and certainty of transit in the conveyance of mails, passengers, and light goods, being considered of paramount importance, has led to a large increase not only in our subsidised mail steam lines, but in private steam-vessels, dispatched periodically to various European and foreign countries. Although our coasting trade has been thrown open now to foreigners for several years, there were only 50,359 tons of foreign shipping engaged in it in 1857, and the large proportion of foreign-owned vessels that took part in the foreign carrying trade sailed under the American flag. The speed and general capacity of our steamers has greatly increased, and hence their voyages are more frequent, and they become more formidable competitors to the sailing ships. These facts will at least serve to convey some idea of the extent and growing importance of our steam marine, and go to prove that it must interfere to a considerable extent with the sailing vessels, by outstripping them, and carrying off a considerable portion of the passenger and goods traffic from distant parts. To have shown what great improvements in the build, speed, increased tonnage, safety, and passenger accommodation have been made in steam-vessels, would have carried our observations too much into detail."

It is singular to note, notwithstanding the magnitude of the subject and the great interests involved in it, that no journal has hitherto been specially devoted to it, as the organ of so vast an industry. Almost every interest at the present day has its special advocate. Shipping generally has its organs, but these devote their attention principally to the sailing marine, whilst steam is comparatively neglected. It is understood, however, that a new journal will shortly make its appearance, under the title of the *Steam Shipping Chronicle*, intended as the special advocate of this great national interest. It is proposed to appear fortnightly, and will come out under the auspices of Messrs. Kelly and Co., of the Post-office London Directory, edited by Mr. P. L. Simmonds, whose papers and contributions to the Society's *Journal* on commercial subjects are well known.

EXAMINATION PAPERS, 1859.

(*Continued from page* 617.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

GEOMETRY AND MENSURATION.

THREE HOURS ALLOWED.

(1.) If one side of a triangle be produced, the exterior angle is greater than either of the interior opposite angles. What series of propositions is necessary to show that the exterior angle is equal to the sum of the interior opposite angles?

(2.) Describe a square that shall be equal to a given rectilineal figure.

> The sides of a quadrilateral are 5, 9, 13, 15 feet respectively, and its opposite angles are supplementary, find the side of a square which is equal to it in area.

(3.) Upon a given straight line describe a segment of a circle which shall contain a given angle. If the line is 4ft. and the angle 30°, what is the area of the segment so constructed?

(4.) Describe an isosceles triangle, having each of the angles at the base double of the third angle. If the base is 4ft., what is the side of the triangle so constructed?

(5.) Equal triangles which have one angle of the one equal to one angle of the other, have their sides about the equal angles reciprocally proportional.

(6.) The rectangle contained by the diagonals of a quadrilateral inscribed in a circle, is equal to the sum of the rectangles contained by the opposite sides.

(7.) If two straight lines be parallel, and one of them is at right angles to a plane, the other is also at right angles to the same plane.

(8.) Every cone is the third part of a cylinder which has the same base and is of an equal altitude with it.

(9.) Show that the area of a trapezium, two sides of which are parallel, is equal to the product of the semisum of the parallel sides and the perpendicular between them.

(10.) The interior and exterior diameters of a pipe 20 ft. long are 3 in. and 3·5 in. What is its solid content?

(11.) A cone, the radius of whose base is 3 ft. and altitude 8 ft., has to be covered with sheet lead of 10lbs. to the superficial foot, at £2 per cwt. What will be the cost of the metal?

(12.) If the diameter of a sphere be 40 ft., what is the solid content of a segment whose altitude is 12 feet?

(13.) What is a rod of brickwork? How do you find the number of bricks in a given surface and thickness?

A wall 20 ft. long has 3 footings, each ½ ft. high. Their respective thicknesses are 4, 3½, 3 bricks; it then rises 8 ft. 2½ bricks thick; then 10 ft. 2 bricks in thickness; then 6 ft. 1 brick in thickness. What will it cost at 12 guineas per rod?

(14.) A room consists of a rectangular part, 24ft. by 16ft., and two semicircular ends; its height is 18ft.; what will it cost to paint the walls at 10d. per square foot, deducting two doors each 4ft. 6in. by 8ft. 4in., two windows each 10ft. by 12ft., and one fireplace 5ft. by 6ft.?

(15.) A sash weighing half a hundred weight has to be balanced by two cast-iron weights, cylindrical, and 3in. in diameter. What will be their lengths, if a cubic foot of cast iron weigh 7,066 oz.?

(16.) If two sides of a triangle be given, the triangle will be greatest when they contain a right angle.

(17.) A B C is a triangle having acute angles at B and C, draw A D perpendicular to B C, and join D with the middle points of A B, A C. Show that the triangle is now divided into four isosceles triangles.

(18.) If a chord of a circle be produced equally both ways, and tangents be drawn from its extremities on opposite sides of it, the line joining the points of contact shall bisect the chord.

(19.) If any number of parallelograms be inscribed in a given parallelogram, the diameters of all the figures shall cut one another in the same point.

(20.) The diagonals of a trapezium, two of whose sides are parallel, cut one another in the same ratio.

(21.) In a complete quadrilateral, each diagonal is harmonically divided by the other two.

TRIGONOMETRY.

THREE HOURS ALLOWED.

(1.) Explain the two kinds of angular measure used in Trigonometry; and express the unit of "circular measure" in degrees, &c.

(2.) Trace the values of the cosine of an angle through the four quadrants; and show that

$$\begin{aligned}\text{Tan. A} &= \text{tan. } (2n\,180^\circ + \text{A.})\\ &= -\text{ tan. } (\overline{2n+1}\;180^\circ + \text{A.})\\ &= -\text{ tan. } (2n\,180^\circ - \text{A.})\\ &= \text{tan. } (\overline{2n-1}\;180^\circ - \text{A.})\end{aligned}$$

(3.) Prove the formulæ:—

$$\text{Sin. } \tfrac{\text{A}}{2} = \tfrac{1}{2}\sqrt{1 + \text{sin. A}} - \tfrac{1}{2}\sqrt{1 - \text{sin. A}}$$

$$\text{Sin. } (60^\circ + \text{A}) - \text{sin. } (60^\circ - \text{A}) = \text{sin. A}$$

$$\text{Sin. } (\text{A} + \text{B}) \text{ sin. } (\text{A} - \text{B}) = \text{sin. }^2\text{A} - \text{sin. }^2\text{B}$$

(4.) Find the values of sin. 18°, and cos. 9°.

(5.) Show that if $\tan\theta = \sqrt{\dfrac{x}{a}}$,

$$(1.)\ \text{Sin.}^{-1}\sqrt{\frac{x}{a+x}} - \text{Cos.}^{-1}\sqrt{\frac{a}{a+x}} = 0$$

$$(2.)\ \text{Sin.}^{-1}\frac{1}{\sqrt{5}} + \text{cos.}^{-1}\frac{1}{3} = 45^\circ$$

(6.) Prove that in any plane triangle

$$c^2 = a^2 + b^2 - 2ab \text{ cos. C},$$

and adapt the formulæ to logarithmic computation.

(7.) How may the sines of small angles be computed? Exemplify the method by computing sin. 15″.

(8.) If a, b, c are the sides, and A, B, C the angles of a plane triangle, prove that

$$(1.)\ \text{Sin. } \frac{\text{A} - \text{B}}{2} = \frac{a - b}{c} \text{ sin. } \frac{\text{C}}{2}$$

$$(2.)\ \text{The area} = \frac{2\,a\,b\,c}{a + b + c} \text{ cos. } \frac{\text{A}}{2} \text{ cos. } \frac{\text{B}}{2} \text{ cos. } \frac{\text{C}}{2}$$

(9.) If $a = 70$, $b = 35$, and $\text{A} = 37^\circ\ 30'$, find B, having given

log. sin. 37° 30′ = 9·7844471. log. 2 = 3010300
log. sin. 17° 43′ = 9.4833165; and diff: for 1′ = 39·52

and show how c may be found.

(10.) Two men are surveying; when each is at a distance of 200 yards from the flag-staff, one finds the angle subtended by his companion and the staff to be 72° 17′; determine the distance between them, taking the logarithms in the preceding question.

(11.) Find the 216th root of ·03549, having given

log. 3459 = 3·5501060
and log. 99·3287 = ·997075

(12.) Solve the right angled triangle, whose right angle is C; when $a = 100$, $c = 196$, log. 7 = ·8450980.

log. sin. 30° 40′ = 9·7076064
log. sin. 30° 41′ = 9·7078194

(13.) If two sides of a spherical triangle are equal, the opposite angles are also equal.

(14.) If a, b, c are the sides, and A, B, C the angles of a spherical triangle, show that

$$(1.)\ \frac{\text{Sin. A}}{\text{Sin. } a} = \frac{\text{sin. B}}{\text{sin. } b} = \frac{\text{sin. C}}{\text{sin. } c}$$

$$(2.)\ \text{Cos. } a = \frac{\text{cos. B cos. C} + \text{cos. A}}{\text{sin. B sin. C.}}$$

(15.) Enunciate and prove Napier's analogies

(16.) In a right-angled spherical triangle cos. c = cos. a cos. b: prove this theorem, and deduce from it the corresponding theorem of plane trigonometry

(17.) Prove that there are only five regular solids.

SOUTH AMERICAN PRODUCTS.

The following letter has been received from a correspondent at Carthagena :—

SIR,—In a case of plants that I had occasion to forward, through the Secretary of the Admiralty, to Dr. Hooker, I have enclosed some specimens which I supposed would be interesting to you or your members, with request a to hand them to you. They consist in:—

No. 3. One strap of the liber of an enormous tree, 100 to 150 feet high, by 6 to 12 feet diameter, without branches up to the top.

No. 9. Some leaves of the same tree as used to make ropes in this country. This would do, I think, for paper material.

No. 4. Panama palms in their natural state.

No. 5. Panama palms accidentally steeped.

No. 6. Panama palms as prepared to make hats.

No. 7. A rope of the liber of a tree after being steeped—tied with the same liber in its natural state—which both seem suitable materials for paper-making.

No. 8. Leaves and fibres of leaves of our wild pine apple.

I have ordered some tons of those different materials, and were it not for the news of war, I should now be in England, to have a trial made of their value.

I have put at the disposition of Mr. Routledge, of the Eynsham paper works, who is an active member of your Society, a bag of the liber No. 3—but so far got no answer.

If those specimens should prove interesting to any persons, I shall be obliged by your giving them my direction, for further particulars.

I remain, &c.,

A. ANTHOINE.

Carthagena, 25th of June, 1859.

The specimens alluded to are now at the Society's House, for the inspection of members and their friends.

ANTIDOTE FOR SNAKE BITES.

In the *Melbourne Examiner*, of the 14th of May last, is an account of a public trial of the value of an antidote for snake bites, said to be known to a Mr. Uunderwood. The experiments were made in the rooms of Messrs. Easey and Co., auctioners, Collins-street, in the presence of about 500 spectators. The snakes employed by Mr. Underwood were a whip-snake, about 15 inches long, and two diamond snakes, one about 20 inches, the other 3½ feet in length. The larger of the diamond snakes Mr. Underwood provoked till it bit himself on the lower part of the fore-finger. A rabbit was bitten several times by the whip-snake, but neither the rabbit nor Mr. Underwood appeared to be in any way inconvenienced by the bites. The experiments were declared, however, not to have been satisfactory, and the secret of the antidote was not revealed.

In another page of the same journal is inserted the following extract from the *Hobart Town Mercury* :—

"According to the *Cornwall Chronicle*, 'the secret so long confined to the heart of Underwood,' in reference to his antidote to the bite of snakes, has at length been discovered, and the common male fern—*polypodium filex mas*—is stated to furnish the remedy. This very common plant has been long known as a specific in the cure of worms, especially the tapeworms—the powdered root being generally used for this purpose; but from circumstances which have transpired it would appear that Underwood uses a decoction, or broth, of the leaves near the root as being stronger, perhaps, than those near the apex of the plant. We believe in the efficacy of this remedy, which may be easily tested by experiments on animals, and its power might perhaps be augmented if used in the form of a tincture—that is, with an ounce of the leaves steeped for a fortnight in a pint of rum or brandy, in which state it could be kept for any length of time, if well corked, without deterioration by fermentation or otherwise. The fern is common in all parts of the island, and may be gathered at any time, so that an antidote so serviceable may be in the hands of everyone."

Home Correspondence.

THE EXAMINATIONS FOR 1860.

SIR,—I feel sure that I express the feelings of many thousands throughout the kingdom, in returning thanks to the Council of the Society of Arts, for their very liberal interpretation of the first resolution which I moved at the last Annual Conference. By extending the privileges of the Examinations to the members of Institutions having an income less than £75 a year by the payment of 2s. 6d. for each candidate, the advantages will be extended to very many who would otherwise be debarred from such an incentive to mental improvement, and I have no doubt it will be found that by such a step the Society of Arts has done more to demonstrate its practical usefulness than by anything previously attempted in the same direction.

It now remains for those who are interested in the extension of the scheme to remove one of the difficulties alluded to in the second resolution, by giving as full publicity as possible to the formation of Local Boards, and the conditions on which they may be made available for their intended purposes, so that as many as possible may take advantage of them. The concessions made by the Council of the Society of Arts might be briefly stated in a handbill, and widely distributed in every locality affected by their operation, and as the expense would be comparatively trifling, it is to be hoped that many will be found not unwilling to incur so small a charge in order to accomplish so great a good. A reference for further information might be made to the secretary of the neighbouring Institution, and the projected benefits appealed to when a canvass is made for new members. If this be energetically carried out with a zeal proportioned to the importance of the object to be gained, the Society of Arts will find no reason to regret that they opened their doors to those who would otherwise have been unable to pay for admission; and the increasing number of candidates will prove that the people of this country are not regardless of the blessings of mental cultivation when fairly placed before them.

In thus acknowledging the debt of gratitude which is due to the Council of the Society of Arts, I am not surrendering the opinion I have previously expressed as to the importance of a more systematic organisation of Local Boards, and the advantage of a more impartial supervision of the final examinations.

I am &c.,

BARNETT BLAKE.

Leeds, 9th August, 1859.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. No.

Delivered on 21st July, 1859.

60. Bills—Universities Incorporation Act Amendment.
63. „ Medical Acts Amendment.
64. „ Thames Conservancy.
Customs—3rd Report of Commissioners.

Delivered on 22nd July, 1859.

96. Justices of the Peace—Return.
99. Magistrates (County Palatine of Lancaster)—Return.
55. Bills—Boundaries (Ireland).
65. „ Westminster New Bridge.
66. „ Local Government Supplemental.
British North America (Exploration by Captain Palisser)—Papers.

Delivered on 23rd and 25th July, 1859.

98. Justices of the Peace (County Palatine of Lancaster)—Return.
100. Friendly Societies (Scotland)—Report by the Registrar.
42 (1). Trade and Navigation—Accounts (30th June, 1859),
103. Caledonian Canal—54th Report of the Commissioners.
69. Bills—Queen's Remembrancer, &c.
70. ,, Police (Counties and Boroughs).
71. ,, Vexatious Indictments.
61. ,, Fireworks Act Amendment.
67. ,, Locomotive (As Amended by the Select Committee).

Delivered on 26th July, 1859.

58 (7). Civil Services—Estimates—Class 7.
101. Civil List Pension—Paper.
106. Lighting Picture Galleries by Gas—Report of the Commission.
109. Trinity House Pilots—Returns.
112. Postal Subsidies, &c. (Canada, &c.)—Return.
113. New Zealand Loan—Return.
68. Bill—Income Tax, &c.

Delivered on 27th July, 1859.

116. Locomotive Bills—Minutes of Evidence, &c.
74. Bill—Military Savings Banks.

Delivered on 28th July, 1859.

94. East India (Public Debts)—Return.
115. Royal Commissions—Return.
117. Prussia (Neutrality)—Copy of a Dispatch.
120. Patents for Inventions—Report of the Commissioners.
72. Bills—Constabulary Force (Ireland).
73. ,, Adulteration of Food, &c. (Amended).
75. ,, Roman Catholic Charities.
76. ,, County Cess (Ireland) Acts Continuance.
77. ,, Manufactures (Ireland) Act Continuance.
79. ,, Colonial Legislatures' Power of Repeal.
80. ,, Barbuda Government.

Delivered on 29th July, 1859.

58. Civil Services, Estimates—General Abstract.
110. Licensed Trades—Return.
105. Bible Board (Scotland)—Return.
51. Bills—Attorneys and Solicitors.
Prussia—Lord John Russell's Dispatch.

Delivered on 30th July and 1st August, 1859.

125. East India (26th Native Infantry)—Return.
124. East India (Public Debt)—Accounts.
122. New Foreign and Indian Offices—Return.
121. Military Estimates—Report from Committee.
114. Military Forces (Colonies)—Return.
107. East India—Home Accounts.
104. Foreign Shipping—Amended Return.
118. Reformatory Schools—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August* 5, 1859.

Dated 28th June, 1859.

1538. G. Dawes, Milton Iron Works, Hoyland, York, and C. J. Carr, Hoyland—Certain imp. in atmospheric and vacuum hammers and stamps, part of which improvements is also applicable to steam and other engines.

Dated 30th June, 1859.

1560. J. Lawson and S. Cotton, Leeds—Certain imp. in machinery for roving, twisting, and spinning flax, cotton, wool, and other fibrous substances.

Dated 6th July, 1859.

1602. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved mode of manufacture of wheel wires for railway carriages and engines, by means of the therein described apparatus.

Dated 8th July, 1859.

1623. J. Gibbs, Brentford, Middlesex—Imp. in the manufacture of brushes, brooms, coverings for floors, mats, scrapers, and other scraping and rubbing surfaces.

Dated July 12th, 1859.

1652. J. Luis, 1B, Welbeck street, Cavendish-square—Imp. in railway car seats and arm chairs. (A com.)
1653. C. J. Proal, 4, Sonth street, Finsbury—The application of photographic impressions or pictures upon fabrics or tissues, for rendering such fabrics or tissues applicable to various useful purposes. (A com.)

Dated 19th July, 1859.

1698. J. Luis, 1B, Welbeck-street, Cavendish-square—A new system of eccentric socket adapted to axletrees. (A com.)
1702. J. C. Riddel, Belfast—Imp. in stalls, loose boxes, and enclosures for horses, cows, pigs, and other animals.

Dated 20th July, 1859.

1704. T. Curtis, and J. Haigh, Leeds—Imp. in the finishing of cloths.

Dated 21st July, 1859.

1711. J. Todd, Castlemains, Haddington—Imp. in machinery or apparatus for dressing or cleansing and separating grains and seeds.
1712. G. Welch, Birmingham—An imp. or imps. in the manufacture of frames for mirrors, pictures, and other articles.
1713. I. Robson, Dalton, near Huddersfield—Imp. in means or apparatus for drying and cuttling cotton warps after being dyed or sized, or after any other process of wetting, and when quick drying is required.
1715. M. Henry, 84, Fleet-street—Imp. in apparatus or machinery for the manufacture of corks and bungs.
1716. E. J. Scott and S. F. Scott, Glasgow—Imp. in the manufacture of boots and shoes.
1717. H. Healey, Ashby Decoy Cottage, near Brigg, Lincolnshire—Imp. in machinery in destroying flies and other insects on growing crops.

Dated 22nd July, 1859.

1718. J. Hartley, Romiley, near Stockport—Imp. in machinery for regulating the velocity of steam and other engines.
1719. J. G. Isham and S. D. Albertson, New York—An improved machine for cutting and shaping bottle and other corks. (A com.)
1720. S. A. Bell and J. Black, Bow-lane, Cheapside—An improved manufacture of fusee.
1721. W. E. Newton, 66, Chancery lane—Imp. in sewing machines. (A com.)

Dated 23rd July, 1859.

1722. J. B. Whitehall, Nottingham, and S. Wheatcroft, New North-road, Middlesex—Imp. in the construction of certain parts of the apparatus or machinery made use of for manufacturing bonnet and cap fronts, rouches, and such like articles of millinery.
1723. H. N. Harrop, jun., Manchestsr—Certain imp. in a cigar lighter and fusee box.
1724. J. Broadley, Saltaire, Yorkshire—Imp. in means or apparatus used in weaving.
1725. J. Tenwick, Clarendon-street, Portsmouth—Imp. in steering apparatus for ships.
1726. W. H. Harfield, Fenchurch-street—Imp. in capstans, riding-bits, and stoppers for working with chains.

Dated 25th July, 1859.

1727. H. Ambler, Halifax—Imp. in explosive projectiles.
1728. J. Rowland, jun., and George Hall, Oldham—Imp in machiney or apparatus for sizing yarns or threads, which said improvements are also applicable to dressing machines, or other similar apparatus.
1729. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in dyeing yarns, threads, or woven fabrics of wool, silk, cotton, linen, or other fibrous or filamentous material. (A com.)
1730. E. Hunt, Glasgow—Imp. in apparatus for indicating and regulating speed.
1731. W. E. Newton, 66, Chancery-lane—Imp. in extracting oil from coal and other substances yielding pyrogenous oils. (A com.)
1732. C. F. Vasserot, 45, Essex-street, Strand—Preventing and removing incrustations in steam boilers. (A com.)

Dated 26th July, 1859.

1733. J. King, Glasgow—Imp. in the treatment of materials used in or resulting from the distillation of spirits.
1735. J. H. Johnson, 47, Lincoln's inn-fields—Imp. in slide valves for steam engines. (A com.)

Dated 27th July, 1859.

1741. E. Winstanley, Ashton-under-Lyne—Imp. in indicators for registering the quantity produced by spinning machinery.
1743. T. Dickins, Middleton, Lancashire—Imp. in dyeing and discharging warps or other yarns or threads, and woven fabrics of silk, wool, cotton, and other fibrous materials.
1745. C. L. Blum, 29, Boulevart St. Martin, Paris—A mechanical apparatus for smoking and colouring pipes.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, August* 5, 1859.]

August 5th.

154. J. Fawcett.
218. J. G. Proger and D. Davis.
338. G. F. Chantrell.
346. J. Smith.
350. J. Hosking.
356. J. B. Redman.
361. E. Wilkins.
362. J. S. Joseph.
368. G. Bower.
369. J. E. Mc Connell.
371. E. Herring.
376. W. A. Covert.
377. R. J. Ellis.
429. R. J. S. Pearce.
456. W. Clark.
468. G. Paul.
505. J. H. G. D. Wagner.
512. C. W. Siemen.
525. A. Martin and A. Crichton.
618. W. E. Newton.
680. A. Mein.
744. J. H. Johnson.

[*From Gazette, August 9th*, 1859.]

August 9th.

386. H. Bruce.
399. T. White.
400. J. Bennett and J. Bennett.
401. G. Betjemann, G. W. Betjemann, and J. Betjemann.
405. R. Bell.
411. J. Wright.
500. R. Mushet.
501. R. Mushet.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, August* 5, 1859.]

August 1st.

1854. J. Y. Borland.

August 3rd.

1840. H. W. Wood.

[*From Gazette, August 9th*, 1859.]

August 4th.

1848. J. Keith.

August 5th.

1876. T. Whittaker.

August 6th.

1885. J. Cartland.
1913. W. Tranter.
1939. J. Brouard and J. Hubert.

Journal of the Society of Arts.

FRIDAY, AUGUST 19, 1859.

EXAMINATION PAPERS, 1859.

(*Continued from page* 634.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

CONIC SECTIONS.

THREE HOURS ALLOWED.

Section I.—Geometrical Conic Sections.

(1.) The focus and directrix being given, it is required to define each of the conic sections in reference to them. Hereby prove that the normal at a point of a parabola bisects the angle between the focal distance and the diameter.

(2.) Prove in the parabola that the subtangent is equal to twice the abscissa.

(3.) A is the vertex, S the focus, M the foot of the ordinate, P a point on the parabola, &c. Prove that

(1.) $(\mathrm{MP})^2 = 4\ \mathrm{AS.\ AM.}$
(2.) $(\mathrm{QV})^2 = 4\ \mathrm{SP.\ PV.}$

(4.) An ellipse being given, find its centre, principal axes, foci, directrices. And show that of all lines drawn from a focus to the curve, that which passes through the centre is the greatest.

(5.) Draw a tangent to a hyperbola from a given point on the curve.

(6.) Prove that the rectangle contained by the perpendiculars from the foci of an ellipse on a tangent is equal to the square of half the minor axis. What form does this theorem take in the parabola?

(7.) Explain a method for describing a hyperbola. Show that by means of a hyperbola any angle may be trisected.

(8.) From a given point on the minor axis of an ellipse draw a normal to the curve. Show that either two or four normals can be drawn from such a point.

(9.) The part of the tangent of a hyperbola which is intercepted between the asymptotes is bisected at the point of contact. Prove this theorem, and hereby show that the area of the triangle contained between the tangent and the asymptotes is constant.

(10.) Define circle of curvature and chord of curvature. Find the radius of curvature and the chord of curvature at any point of a parabola.

(11.) An ellipse is orthographically projected into a circle. What, relatively to the circle, are the projections of (1) a pair of conjugate axes; (2) a pair of supplemental chords; (3) a parallelogram circumscribing the ellipse with its sides parallel to conjugate axes?

(12.) Prove that every plane section of a cone which cuts both the cone and its conjugate cone is a hyperbola.

(13.) Through any point two planes can be drawn cutting an oblique cone, such that the sections of the cone shall be circles.

Section II.—Analytical Conic Sections.

(1.) Construct formulæ for passing from one rectangular system to another when the origin is unchanged, and transform the equation $x^2-y^2=a^2$ to axes bisecting the angles between the original axes.

(2.) Find (1) the equation to the line passing through (x_1, y_1) and perpendicular to the line passing through (x_2, y_2) and (x_3, y_3); and (2) the length of the perpendicular from (x_0, y_0) on the line thus determined.

(3.) Find the general equation to the tangent of a circle and prove that it is perpendicular to the radius of the circle at the point of contact.

(4.) C is the centre, S and H are the foci, CP and CD are conjugate semi-axes of an ellipse whose equation is $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$, show that

(1) $\mathrm{SP}=a+ex$, $\mathrm{HP}=a-ex$:
(2) $\mathrm{SP}\times\mathrm{HP}=(\mathrm{CD})^2$.

(5.) Prove analytically the theorems contained in questions 2, 6, 9 of the preceding section.

(6.) Examine and trace the lines represented by the following equations:—

(1) $4x+3y+12=0$
(2) $x^2+y^2-4x-6y-3=0$
(3) $x^2+2xy+y^2-x+y-6=0$
(4) $2x^2-2xy+y^2-4x+6y-10=0$

STATICS, DYNAMICS, HYDROSTATICS, HYDRAULICS, AND PNEUMATICS.

THREE HOURS ALLOWED.

(I.)

(1.) Define the terms pressure, velocity, momentum, accelerating force, moving force; and illustrate by examples.

(2.) State and prove the conditions of equilibrium on an inclined plane.

(3.) What principle must be assumed in order to prove the property of the lever? Describe the different kinds of levers; and illustrate by examples.

(4.) Explain the principle of the Archimedean screw for raising water.

(5.) Shew that the density of air is proportional to the compressing force.

(6.) What is the law of inertia? Give proof and examples.

(7.) Explain the principle of Barker's mill.

(8.) Action and reaction are equal and in opposite directions. Is this universally true, or under what conditions? Give proof.

(9.) What is the nature and law of centrifugal force? Give proofs and examples of its application.

(10.) What mechanical powers are employed in rowing, sailing, and steering a boat?

(11.) Why does a person in carrying a weight on his back, bend forward; in front, backward, and on his head, keep upright?

(12.) Describe the essential parts in the construction of a clock, a watch, and a chronometer.

(II.)

(13.) If a body move from rest by a constant force, shew that the space described, from the commencement, varies as the square of the time, experimentally or mathematically.

(14.) In the same case, prove that the space described is half that which would be described in the same time with the last acquired velocity continued uniform.

(15.) State and demonstrate the chief properties of a simple pendulum; vibrating either in a cycloid or in a small circular arc.

(16.) Explain the compensation pendulum, and describe any varieties of construction.

(17.) Explain the application of the barometer to the measurement of heights.

(18.) Define the centre of gravity of a body, and find its position, either experimentally or mathematically, in a triangle, a semi-circle, a parabola, supposed of uniform density.

(19.) What is capillary attraction? Describe any experiments illustrative of its nature and laws.

(20.) Define the "principal axes" of a rotatory body, and mention any experimental illustration of the case.

(21.) Explain the "composition of rotatory motion," and mention any remarkable application of the principle.

(22.) Describe the gyroscope; explain the principle of its application to showing the rotation of the earth, and the suspension of a rotating disk against gravity.

(23.) State the law of "conservation of areas." Give any proof of it, experimental or mathematical, and state any remarkable application of it.

(24.) Define "moment of inertia," and show the means of finding the "centre of gyration" of a body.

PRACTICAL MECHANICS.

THREE HOURS ALLOWED.

(1.) Describe the screw-cutting lathe. What is the pitch of a screw? How are screws of a different pitch cut in the lathe? Explain the arrangement for cutting left-handed screws.

(2). Show that power may be gained by combinations of toothed wheels, and give the illustration which occurs in the double geared headstock of a turning lathe.

(3.) Describe the common mangle wheel, and state some methods of obtaining a reversing motion in machinery.

(4.) Explain the principle of the fire engine and of the centrifugal pump.

(5.) What is the dynamical statement of the Principle of Work. Find the amount of work stored up in a flywheel of given form and weight, and making a given number of revolutions per minute.

(6.) Mention some experiments to prove that the pressure of steam from water boiling in the air is equal to that of the atmosphere. Explain the advantage of working steam expansively, and state generally the properties of steam.

(7.) Describe the common condensing beam engine.

(8.) What is the horse power of an engine, and how is it ascertained?

(9.) Describe the eccentric. Explain the contrivance for reversing a locomotive engine.

(10.) Discuss the nature of the action which takes place between the pendulum and the clock train in the cases of the recoil and dead beat escapements.

(11.) What is the general arrangement of a sawing machine. How is the piece of timber advanced for each cut.

(12.) Describe the hydrostatic press. Show how to calculate the power called forth. Give details of the working parts, and state some useful applications of this machine.

ELECTRICITY, MAGNETISM, AND HEAT.

THREE HOURS ALLOWED.

(1.) Explain magnetic induction, and the conditions of magnetic attraction and repulsion.

(2.) Give some account of the distribution of terrestrial magnetism. What are isodynamic lines?

(3.) In what manner is terrestrial magnetism influenced by solar heat?

(4.) Explain diamagnetism, and mention some substances that exhibit this property.

(5.) State the phenomena accompanying the excitation of electricity by friction.

(6.) Explain the construction and action of an electrophorus.

(7.) Give some account of the apparatus for protecting ships from lightning, and the conditions essential to its action.

(8.) Describe a voltaic element, and its mode of action.

(9.) Explain the terms, quantity, and intensity, in relation to a battery, and state under what circumstances these different conditions are required.

(10.) Explain the construction and action of a dry pile.

(11.) By what arrangements are magnetic properties developed by a voltaic current? Mention some practical applications.

(12.) What are the peculiar characters of a thermo-electric current, and by what means is it produced?

(13.) Describe the electric organs of some animal possessing them.

(14.) State and explain the effect of a galvanic current on muscular action.

(15.) Explain the construction of a submarine cable.

(16.) What is the construction and object of a "relay?"

Heat.

(17.) State the influence of heat on the physical properties of bodies.

(18.) What is meant by the convection of heat? Describe some apparatus acting on this principle.

(19.) Explain the means of measuring heat, and the principal sources of error.

(20.) If a vessel containing water heated to 300° C. were suddenly opened, would the whole, or what proportion of it, fly off in steam.

(21.) Show by experiments that heat obeys the ordinary laws of reflexion.

(22.) State the conditions essential to efficient ventilation.

(23.) Explain the "dew point," and the means of observing it.

(24.) On what conditions does the difference in the sensible warmth or coldness of two substances, as wood and iron, at the same temperature, depend? Apply this principle to clothing.

(*To be continued.*)

NAPHTHA.

By M. C. Cooke.

A considerable number of inflammable mineral substances are known under the names of asphaltum, bitumen, petroleum, and naphtha, differing in colour and solidity, but these names are often applied very indiscriminately, and, as at present commonly used, do not denote precisely the character of the substance so named. Generally, however, the limpid, yellowish, transparent fluids are called *naphtha*. These on exposure to the atmosphere evaporate partly, leaving a substance nearly black, and of the consistence and colour of tar, which is then called *petroleum;* in this form it also oozes from the earth in many places. A third kind is solid, with a glossy conchoidal fracture, resembling pitch, and this either bears the name of *bitumen* or *asphaltum.* Recent applications of these bituminous substances have suggested a short account of the principal sources whence they have been obtained. To classify them under the three heads above named would not be a task so readily performed, from the accounts we possess, and in the absence of specimens for comparison. In some instances, two or more of the varieties are also found in the same localities. Hence the only arrangement which can be adopted is a geographical one. Comprising :—

1. European, *i.e.*—British and Continental.
2. Asiatic—Western and Eastern.
3. American—North, South, and Insular

The British sources of bituminous substances are not so numerous or prolific as to render them available to any extent commercially. In Derbyshire it has been pumped up from certain coal mines, sometimes in considerable quantity. Dr. Ure states to the extent of 100 gallons daily. In Shropshire it has also been obtained; also in Lancashire and Cornwall. In Scotland, asphaltum has been found in East Lothian, and naphtha at St. Catherine's well, near Edinburgh, and in Pomona, one of the Orkneys.

A kind called *elaterite*, or elastic bitumen, of rare occurrence, has been found near Castleton, in Derbyshire, in a coal mine a few miles from Angers in France, and in a coal mine in Massachusetts, in the United States. This substance resembles in many of its properties the gum elastic, or fossil caoutchouc; it fuses readily, and at a higher temperature takes fire, and burns with a sooty flame, but from its scarcity no attempt has been made to utilize it, and therefore it is of no commercial value.

In continental Europe there are numerous naphthaline springs. At Monte Ciaro, near Piacenza; at the lake of Tegern, in Bavaria; near Neufchatel, in Switzerland; in the department of Ain, in France, bitumen is accompanied with a copious flow of water on which it floats, and from which it is skimmed. There are also abundant supplies in several parts of the Duchy of Modena. Pietra Mala, Fanano, Mount Zibio, and Amiano, furnish the naphtha of the Genoese markets. The naphtha of Amiano is of a topaz yellow colour, and readily burns without leaving any residue. It rises in considerable quantities, and is used for lighting. A spring was noticed by Benjamin, of Tudela, at Puzzuola in the twelfth century. "This city," he writes, "has been inundated in two spots by the sea, and even to this day you may see the streets and towers of the submerged city. A hot spring which issues forth from under the ground produces the oil called petroleum, which is collected upon the surface of the water and used as medicine." There are also springs at Zante which are known to have been at work for upwards of 2,000 years. Herodotus wrote of them in the following words:—"I have myself seen pitch drawn up out of a lake, and from water in Zacynthus; and there are several lakes there, the largest of them is seventy feet every way, and two orgyæ in depth; into this they let down a pole with a myrtle branch fastened to the end, and then draw up pitch adhering to the myrtle; it has the smell of asphalt, but is, in other respects, better than the pitch of Pieria. They pour it into a cistern dug near the lake, and when they have collected a sufficient quantity they pour it off from the cisterns into jars. All that falls into the lake passes underground, and appears again upon the surface of the lake, which is about four stades distant from the lake." These wells are situated about 12 miles south of the town of Zante, in a marshy district in the south-east part of the island.

The valley containing the bitumen is the segment of a circle, surrounded on three sides by abrupt and rugged ridges of hills, and on the fourth by rocks rising above the water as if the sea had at some period burst in and destroyed the continuity. In the marsh within the circle are several wells or pits; one examined was about nine feet in diameter and surrounded by a dwarf wall. The water was about two feet below the edge, and one foot deep, the surface covered with a scum which reflects various iridescent colours; the blue and green are very vivid, a dark black substance continually forcing its way from the bottom, and boiling up in large globules, which as they ascended enlarged, till near the surface, and then burst, liberating a quantity of gas which the peasantry say is highly inflammable. Sometimes the globules are transparent, and assume a singular brilliancy, rising to the top and bursting, while a coating of dark bituminous matter in which they were invested is thrown off. This dark substance is the petroleum or rock-pitch, which being specifically heavier than the water remains below, covering the sides and part of the bottom. The brilliant globules disengaged from it are pure naphtha, which forms a light oleaginous strata above, reflecting various beautiful colours. The intervening water is strongly impregnated with a taste like tar-water, and it is prescribed in various dyspeptic complaints. The pitch is collected with large spoons into a pit adjoining the well, and thence thrown into barrels. The best time for gathering it is in summer, when it is exuded in the greatest quantities; and they annually fill about 100 barrels, which is used for smearing the bottom of ships and similar purposes.—MARTIN.

In several places in Sicily are fountains which throw up a kind of earth oil on their surface, which is used by the peasants, who burn it in their lamps, and use it for many other purposes. But there is a more remarkable one near Nicosia, which is called Il Fonte canalotto. It is covered with a thick scum of a kind of pitch, used by the country people as a specific in rheumatism. Petroleum has also been obtained at Puklemicza in Hungary, at Tegernsee, in Transylvania, in Moldavia, and in Wallachia. A solid kind has been found in limestone at Bleiberg, in Carinthia, in beds of sandstone in Albania, and in veins in the Hartz, in Germany. The asphalt of Seyssel and other parts of France and Switzerland has been long used for paving. The Pyrenees and the Caucasus are also affirmed to yield varieties of this substance.

The principal bituminous districts of Western Asia are those of the Tigris, the Caspian, and the Dead Sea. The former of these are, in part, described by Mr. W. Ainsworth:—"Leaving Wadi-l-Kasab, we approached the Tigris a few miles below the tomb of Sultan Abdullah, and came to a level naked spot inclosed by rocks of gypsum, on the floor of which were innumerable springs of asphalte or bitumen oozing out of the soil in little circular fountains from six to 9 inches in diameter, but often buried beneath or surrounded by a deep crust of indurated bitumen. These fountains cover a space of land nearly a hundred yards in width and five hundred long. To the west are some low hills, named Al Kayyarah, or the pitch place. These heights are continued inland in a north-westerly direction, separating Wadi-l-Kasab from the plains to the south, and rising to a height of about 500 or 600 feet to form a cliff bounded by two cones, and called Tell-al-Nujm or Star mound. A little beyond these pits we found other springs giving off an equal quantity of bitumen. These are the only cases I know of springs of pure asphalte in Western Asia. The celebrated springs at Hit, and those of Doulakee, in Persia, give off bitumen as a swimming product as at Hammam Ali. The fountains of asphalte on the Tigris are situated near the southern extreme of the gypsum formation, where it is succeeded by red sandstone, &c."

At the thermal springs of Hammam Ali the waters are abundant, evolving hydro-sulphurous acid, and giving off much bitumen.

The springs called Oyun Hit (the fountains of Hit) are celebrated by the Arabs and Persians; the latter call them *cheshmeh kir* (the fountain of pitch). This liquid bitumen they call *nafta;* and the Turks, to distinguish it from pitch, give it the name of *kara sakiz* (black mastic). A Persian geographer says that nafta issues out of springs of the earth, as ambergris issues from those of the sea. All modern travellers, except Rauwolf, who went to Persia and the Indies by way of the Euphrates, before the discovery of the Cape of Good Hope, mention this fountain of liquid bitumen as a strange thing. Some of them take notice of the river mentioned by Herodotus*, and assure us that the people of the country have a tradition, that when the tower of Babel was building, they brought the bitumen from hence, which is confirmed by Arab and Persian historians.

The following quaint account is given of these springs:—

"Hit, Eit, or Ait, as it is variously written by travellers, is a great Turkish town, situate upon the right or west side of the Euphrates, and has a castle, to the south-west of which, and three miles from the town, in a valley, are many springs of this black substance, each of which makes a noise like a blacksmith's forge, incessantly puffing and blowing out the matter so loud that it may be heard a mile off; wherefore the Moors and Arabs call it Bab al Jahennam, that is, hell-gate. It swallows up all heavy things, and many camels from time to time fall into the pits, and are irrecoverably lost. It issues from a certain lake, sending forth a filthy smoke, and continually boiling over with the pitch, which spreads itself over a great field that is always full of it. It is free for everyone to take; they use it to caulk or pitch their boats, laying it on two or three inches thick, which keeps out the water; with it also they pitch their houses, made of palm-tree branches. If it was not that the inundations of the Euphrates carry away the pitch, which covers all the sands, from the place where it rises to the river, there would have been mountains of it long since. The very ground and stones thereabout afford bitumen, and the fields abundance of saltpetre."

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* Eight days' journey from Babylon stands another city, called Is, on a small river of the same name, which discharges its stream into the Euphrates; now this river brings down with its water many lumps of bitumen, from whence the bitumen used in the wall of Babylon was brought.—HERODOTUS I. 179.

A later traveller states that "the number of bitumen springs in the neighbourhood of this place is very great, and the produce of a single spring is sufficient to meet the demand, though it is used in these parts as fuel. A great number of river boats, of different sizes and forms, are made here. They consist of wicker work, made of branches from one-and-half to two inches in thickness. The interstices are filled up with straw, and then the whole is caulked with bitumen. In such boats the bitumen, salt, and prepared lime, are taken to Hillah, Bassora, and Baghdad."

Major Rawlinson states that, at the pits of Kir ab ur Susiana, the liquid bitumen is collected at the present day in the same way as is related by Herodotus.* The ground is impregnated with this noxious matter, and the waters are most unwholesome.

There are, besides, other pits at Bandi Kir, and near Ram Hormuz.

Of the Persian naphtha or petroleum, there are said to be two kinds, the white and the black. Of the latter, there are several fountains in Irak Arabi, but the most productive are near Kerkook. It is employed by the natives as a substitute for pitch, and is also used in lamps instead of oil. The white naphtha is found floating like a crust on the surface of the water; it is of a much thicker consistence, resembling tallow rather than pitch, and affords a better light, as well as emits a less disagreeable odour than the black naphtha. Two fountains of this kind rise near Doulakee, in Fars, but the most remarkable are found near Baku, on the western shores of the Caspian. A liquid black petroleum, of an agreeable odour, flows in small quantities from a mountain in Kerman; this was formerly a Royal monopoly, and the mines were carefully sealed and guarded.

Caspian District.—The peninsula of Apscheron abounds in bitumen. Round the town of Baku there are nearly one hundred bituminous springs, some of which are worked, supplying petroleum and black and white naphtha. Other fountains in the neighbourhood have for ages emitted a burning stream which is called the "Indian fire." The naphtha with which the soil is charged not only streams spontaneously through the surface, but rises wherever a hole is bored. It is of two descriptions, black and white, and the principal sources are situated at a spot called Balegau, about six miles from Baku. The colour of the oil is black, but it shines with a reddish tint when the suns rays are upon it; the natives use it for burning as a light, and paint their roofs with it. Not far from the same spot a spring of white oil gushes out at the foot of a hill. It readily inflames, and burns on the surface of the water, and in calm weather the people of the country amuse themselves by pouring whole tons of it into a bay of the Caspian; they then set fire to it, and it is borne out of sight, giving the waves the appearance of a sea of fire. The whole of these naphtha springs belong to the Government. The weavers and other poor persons of the neighbourhood obtain a cheap light and abundance of heat for cooking, by driving a clay pipe or hollow reed, steeped in lime water, into the ground on which their dwelling stands, and setting fire to the gas which rises through it. The Asjur Meisjan or Burning Field, near Baku, is a hollow expanse, full of fissures, and coated with white sand and grey dust, in which particles of sulphur abound. Some fissures are seen burning, some smothering, and others emitting naphtha vapours. There is a boiling lake not far from the town, which is in constant motion and gives out a flame, altogether devoid of heat. After the warm showers of autumn, when the atmosphere is scorching, the whole surrounding country appears to be on fire, and it frequently rolls along the mountains in enormous masses, and with incredible velocity. At other times it stands motionless. If the night be dark, innumerable jets of flame, sometimes isolated, and at others in masses, cover all the low ground, leaving the mountains in obscurity. The fire does not burn, and when in the midst of what every one would conceive to be a devouring element, it is impossible to detect the least heat in it. The reeds and grass are in no way affected by it. These appearances never occur when the wind blows from the east.

Petroleum is also found in great quantities on the island of Naphthalia or Tchilehon, the largest of the islands of the Caspian sea, situated in the Bay of Balkau.

The soil near Derbent, on the north-west coast of the Caspian, and near the gulf of Baku, from which the naphtha oozes into wells about thirty inches deep, is a clay marl which is thoroughly soaked with that fluid. It has a pale-yellow colour like that of Amiano, but has a specific gravity of 0·853, while that of Amiano is only 0·836; their boiling point is 305° Fahr. Barbados tar differs from these naphthas only in containing a little more bitumen, but it is equally fragrant.

Dead Sea District.—The Arabs call the asphalte of the Dead Sea *Hajar Mousa* (Moses's Stone). It is found floating on the surface of the sea, or scattered in lumps along the shore.

The Arabs who accompanied Dr. Robinson believed that it appears only after earthquakes. They related that after the earthquakes of 1834, a large quantity of asphaltum was cast upon the shore near the south-western part of the sea, of which the Jehâlin brought about 6,000 lbs. into the market. After the earthquake of 1837, a large mass of bitumen, one said like an island, another like a house, was discovered floating on the sea, and was driven aground on the western side, not far to the North of Usdum. The Jehâlin and the inhabitants of Yutta swam off to it, and cut it up with axes, so as to bring it to the shore. The Ta Amirah heard of it, and went to get a share. They found seventy men already upon and around it. This mass of bitumen was carried off by camel loads. It is only in the southern portion of the sea, so far as Dr. Robinson ascertained, that bitumen is obtained. Bitumen wells, it is said, have been found at the northern extremity of the land.

In Eastern Asia, bituminous substances have been found in Burmah, on the Aracan coast, in China, and Japan. The best known are the Burmese springs. At Rangoon, on one of the branches of the Irawaddy, there are upwards of five hundred naphtha and petroleum wells, which afford annually 412,000 hogsheads. The Rangoon wells are about two miles from the village of Yay-nan-Goung, where they occupy a space of about twelve square miles. They are from 200 to 300 feet deep, of small calibre, and sustained by scantling. The temperature of the oil when first raised to the top is 89°; men do not go down, but an earthern pot is lowered in and drawn up over a beam across the mouth, by two men running off with the rope. The pot is emptied into a little pool, where the water with which it is largely mixed subsides, and the oil is drawn off pure. It is exported in earthern jars containing about 30 pounds. The price about twenty years ago was about 2½d. per lb. A well yields about 1,200 or 1,500 lbs. per day, and is worked by three or four men. Sometimes upwards of 2,000 lbs. are obtained. The amount depends on the quantity of water drawn up with the oil. A duty of $\frac{1}{20}$th is paid to the government. This useful oil is extensively used for lamps and torches, and is exported to all parts of the empire, whither it can be taken by water. It is also used for preserving wood, mat partitions, palm leaf, &c., from insects, and from the weather. Even the white ants will not attack wood which has been brushed with it.

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* "At Ardericca (Kir ab) is a well which produces three different substances, for asphalt, salt, and oil are drawn up from it in the following manner:—It is pumped up by means of a swipe, and instead of a bucket half a wine-skin is attached to it; having dipped down with this, a man draws it up, and then pours the contents into a reservoir, and being poured from this into another it assumes three different forms; the asphalt and the salt immediately become solid, but the oil they collect, and the Persians call it *rhadinace;* it is black and emits a strong odour." —Herodotus VI. 119.

In the salt-wells of the province of Sse-tchouen, in China, a bituminous oil is found, that burns in water. Sometimes as many as four or five jars, of a hundred pounds each, are collected in a day. The oil is very fetid, but it is made use of to light the sheds in which are the wells and cauldrons of salt. The mandarins, by order of the Prince, sometimes buy thousands of jars of it, in order to calcine rocks under water, that render the navigation perilous. When a shipwreck takes place, the people make a kind of lamp of this oil, which they throw into the water near the spot, and then a diver, and oftener still a thief, goes down to search for any article of value that he can carry away, the subaqueous lamp lighting him perfectly. Strong bituminous vapours issue from the earth, which are lighted at the surface, and serve as fires for evaporating the water obtained from the wells to procure the salt. Thus much is related by Mr. Imbert, a missionary for a long time in this province.

Capt. Halstead, of H.M. ship *Childers*, collected specimens of petroleum at Cheduba, on the Aracan coast. The colours varied from cherry red to nearly opaque tar-like brown. This petroleum appears to be nearly identical with that of Barbados and Persia.

Naphtha of a reddish colour, by the Japanese called *tsutsono abra*, which signifies red earth, is found in a river of the province Jessing, in Japan. It is taken up in such places where the water has little or no run, and the natives burn it in lamps instead of oil.

A similar substance, called stone oil, is also found in parts of the Chinese Empire; and it has been noticed in Siberia and in the Altai mountains.

Africa.—No part of Africa with which we are at present acquainted, would appear to yield naphtha or asphalte, with the exception of the Atlas mountains, and Egypt. From the latter place petroleum, resembling in colour and consistency that of Barbados, has been exported, as well as solid asphalte, although from what part of the country obtained we are unable to state.

North America.—In North America it has been found in several places. Mr. Dana says that, in the United States it was formerly collected for sale by the Seneca and other Indians. The petroleum is therefore called Genessee or Seneca oil, under which name it is sold in the market. Beside the springs at Seneca Lake and in Kentucky, there are also springs in Newfoundland, Nova Scotia, and New Brunswick. Sir J. Richardson states that, on the banks of the Mackenzie river there are different beds, containing variable quantities of bitumen. "The whole country is so full of it for many miles, that it flows readily into a pit dug a few feet below the surface."

In Texas there is reported to have been discovered recently a lake very similar to that of Trinidad. "It is situated in Jefferson County, about a hundred miles from Houston. It is about a quarter of a mile in circumference. In the summer months there is a spring near the middle of the lake, where an oily fluid, like petroleum, continually boils up from the bottom. This liquid gradually hardens on exposure to the air, and forms a black pitchy substance. It burns when lighted with a clear bright light, but gives out a very pungent odour. During the winter the bitumen in the lake presents a hard surface, and is covered with water having a somewhat sour taste."

About 1830, while boring for salt-water near Burksville, Kentucky, after penetrating through solid rock upwards of 200 feet, a fountain of pure petroleum was struck, which was thrown up more than twelve feet above the surface of the earth. Although in quantity somewhat abated after the discharge of the first five minutes, during which it was supposed to emit seventy-five gallons a minute, it still continued to flow for several days successively to the mouth of a small creek, emptying into Cumberland River, and for a long time covered its surface. Some gentlemen below applied a torch, when the surface of the river blazed, and the flames soon climbed the most elevated cliffs, and scorched the summit of the loftiest trees.

In Canada, petroleum is found on the Thames, River St. Jean, and Ruisseau Argenté (Gaspé), and Asphaltum, at Enniskillen.

South America.—For accounts of the South American sources of these products we are chiefly indebted to Humboldt.

In the gulf of Cariaco petroleum issues from a soil of mica slate. Further east, on the banks of the Arco, and near Cariaco, it seems to gush from secondary limestone formations, but probably that happens only because those formations repose on mica slate.

Proceeding along the southern coast, to the east of Maniquarez, we find running out into the sea, very near each other, three strips of land, bearing the names of Punta de Soto, Punta de la Brea, and Punta Guaratarite. In these parts the bottom of the sea is evidently formed of mica slate; and from it, near Cape de la Brea, but at eighty feet distant from the shore, there issues a spring of naphtha, the smell of which penetrates into the interior of the peninsula. The bottom of the gulf is covered with sand, and the petroleum, which from its transparency and its yellow colour resembles naphtha, rises in jets accompanied by air-bubbles. On treading down the bottom with the foot, we perceive that these little springs change their place. The naphtha covers the surface of the sea to more than a thousand feet distant.

In the muriatiferous clay of Araya is found a solid and friable petroleum, and in the peninsula of Araya the naphtha flows from the primitive rock itself.

From Punzera, the road leads by Torecin and Nuova Palencia to the port of San Juan, situated on the right bank of the river Areo, and it is only by crossing this river in a canoe that the traveller can arrive at the famous petroleum springs of the Buen Pastor. They were described to Humboldt as small wells or funnels hollowed out by nature in a marshy soil. From hence the lake of chapapote, of Laguna de la Brea, in the island of Trinidad, is distant, in a straight line, only thirty-five sea leagues.

A petroleum spring also gushes from a shoal to the north of the Caracas Islands. The smell of this spring warns ships of the danger of this shoal, on which there is only one fathom of water.

The aperture of Mena, on the borders of Lake Maracaibo, throws up asphaltum, and is said to emit gaseous emanations, which ignite spontaneously, and are seen at a great distance.

The asphaltum springs of Trinidad are, however, the most important of the South American bituminous exhalations, for they must be considered as belonging to South America, and at the same time forming a link between them and the springs of the West Indian Islands.

The pit which throws up asphaltum in the Bay of Mayaro, on the Eastern Coast, southward of Point Guataro, is the mine of chapapote, or mineral tar of the country. Humboldt was assured that, in the months of March and June, the eruptions were often attended with violent explosions, smoke, and flames.

South-east of the port of Naparimo, in a clayey ground, appears the celebrated lake of asphaltum, a marsh, the waters of which have the same temperature as the atmosphere.

Petroleum is found floating on the sea thirty leagues north of Trinidad, around the island of Granada, which contains an extinguished crater, and basalts.

Dr. Nugent, writing of the Trinidad lake, says, "We soon after had a view of the lake, which, at first sight, appeared to be an expanse of still water, frequently interrupted by clumps of dwarf trees, or islets of rushes and shrubs, but on a nearer approach we found it to be in reality an extensive plain of mineral pitch, with frequent crevices and chasms filled with water. The singularity of the scene was altogether so great, that it was sometime before I could recover from my surprise so as to investigate it minutely. The surface of the lake is of the colour of ashes, and at this season was not polished or smooth so as to be slippery; the hardness or consistence was such as to bear any weight, and it was not adhesive, though it partially received the impression of the foot; it bore us without any tremulous motion whatever, and several head of cattle were browsing on it in perfect security. In the dry season, however, the surface is much more yielding, and must be in a state approaching to fluidity, as is shown by pieces of recent wood and other substances being enveloped in it. Even large branches of trees, which were a foot above the level, had, in some way, become enveloped in the bituminous matter.

The interstices, or chasms, are very numerous, ramifying and joining in every direction, and in the wet season being filled with water, present the only obstacle to walking over the surface. These cavities are generally deep in proportion to their width, some being only a few inches in depth, others several feet, and many almost unfathomable. The water in them is good, and uncontaminated by the pitch. The people of the neighbourhood derive their supply from this source, and refresh themselves by bathing in it. Fish are caught in it, and particularly a very good species of mullet. It is not easy to state precisely the extent of this great collection of pitch; the line between it and the neighbouring soil is not always well defined, and, indeed, it appears to form the substratum of the surrounding tract of land. The depth cannot be ascertained, and no subjacent rock or soil can be discovered. Where the bitumen is slightly covered with soil, there are plantations of cassava, plantains, and pine apples, the last of which grow with luxuriance and attain to great perfection. In some parts it is so hard as to require a severe blow of the hammer to detach or break it. In other parts it is so much softer, as to allow one to cut out a piece in any form with a spade or hatchet, and in the interior is vesicular and oily; this is the character of by far the greater portion of the whole mass. In one place it bubbles up in a perfectly fluid state, so that you may take it up in a cup, and I am informed that, in one of the neighbouring plantations, there is a spot where it is of a bright colour, shining, transparent, and brittle, like bottle glass or resin. The odour in all these instances is strong, and like that of a combination of pitch and sulphur. A bit of the pitch held in the candle melts like sealing wax, and burns with a light flame, which is extinguished whenever it is removed, and on cooling the bitumen hardens again.

Combined with sand and rubble this asphalte is stated to form a good paving for the chief town of Port of Spain. It is proposed to utilise it on a large scale, and by mixing it with chips of wood, to obtain every year 5,000 tons of fuel, by which the West India steamers could save much of the coal they are obliged now to carry with them from England.

In the island of Barbados are several bituminous springs which yield the substance known as Barbados tar. Near Springfield, in a ravine formed by two mountains, is a surprising quantity of petroleum. In the neighbourhood of Conset's Bay rises a hill which is locally known under the name of Burnt Hill. It is reported as having been set accidentally on fire by a slave, and that it continued to burn for the space of five years. Petroleum oozes in large quantities out of the rocks near the beach. Among the shingle are found large cylindrical bodies consisting of ferruginous clay coated with bitumen. Near Mount All is a spring called "The Pottery," on the surface of which floats plentifully, naphtha, or green Barbados tar.

After the adoption of the manufacture of gas from coal, it was found that the substance called coal tar, one of the products of this manufacture, very closely resembled Barbados tar in its physical character; and for many years coal tar was almost entirely substituted for, and sold under, the name of Barbados tar in this country. Coal tar also yields, by distillation, a volatile fluid, which has been called naphtha.

The Barbados green tar, or petroleum, has been used with success in cases of leprosy. Mr. Abel Stuart petitioned the House of Assembly to erect upon Bird Island a hospital for the more convenient prosecution of his labours in the cure of leprosy by means of the green tar.

In some places in the Island of Cuba petroleum flows from rents in the serpentine. Sebastian de Ocampo, in 1508, employed a substance called "betun liquido," for the caulking of ships. This was near the port of Havanna. It is said that abundant springs are also found in the eastern part of the Island, between Holguin and Mayari, and on the coast of Santiago de Cuba.

This enumeration of the sources of naphtha, and its allies is doubtless imperfect, but in the absence of any collected information on the subject this attempt may furnish some assistance either to those interested in the commerce or extended utilization of these substances, or to any who may be desirous of forming for themselves a more complete digest of the distribution of this mineral over the surface of the globe.

COPPER COINAGE.

The condition of copper coinage of this country has been under investigation by the Government. A large portion has been found to be in a very bad condition. A considerable part of it is very old. Rather more than one-fifth bears dates between 1797 and 1805. It varies in weight, and although the practical inconvenience is perhaps not very great, because the public are familiar with it, yet if an old and a new penny were shown to persons unacquainted with them, no one would ever dream that they represented the same value. The old penny is worth intrinsically nearly half as much again as the new one. The old penny was coined at the rate of sixteen to the pound, and the lightest of the new twenty-six to the pound. Only fifteen per cent. of the copper coinage dates since 1852. The whole value of the copper coinage is £800,000, and the quantity of copper is 3,530 tons. Taking the copper at £107 10s. per ton, the actual value is only £379,000, so that the copper coin is a pure token, the intrinsic value being less than one-half the nominal or apparent value. In order to ascertain the state of the copper coinage a considerable quantity has been examined in the large towns. The copper coinage of towns is better than that of the country, because old coins always linger longer in the rural districts. The result of the investigation in London, Birmingham, and other large towns shows that about one-third of the whole is below its legal state, and ought to be withdrawn. A part of it is counterfeit, another part consists of foreign coins, and another part is injured, battered, and inscribed, according to the fancy of individuals. The result is that one-third requires renewal. If it were renewed, such as it now is, a cost of about £40,000 would be incurred, but by the mode intended to be adopted by the Government, although an outlay of £50,000 will be required in the first instance, this expense will be entirely covered by the profit arising from the change of material. The Chancellor of the Exchequer, in his speech in Parliament, explained the intentions of Government as follows:—

"He believed the copper coinage admitted of considerable improvement. It was exceedingly heavy, and the metal was not very agreeable handling. It communicated a smell, and it was very easy to substitute a metal more convenient. It would be an admirable practice to follow in the beat of our continental neighbours. Gentlemen would recollect what was the state of the old copper coinage of France. It was much the same as our own. The coins had almost lost all signs of any effigy, and were rudely shaped lumps of metal. Within the last few years it had been called in, and a bronze metal substituted. He held in his hand a French penny, which was a very little larger than an English halfpenny. It was very convenient, very nice in appearance, and a most agreeable coin to handle. It was a much more desirable coin than ours, and the result of the operation, as he was informed, had been that the French had paid for the expense of converting the coin, and realised from the reduction of weight a profit not far short of £500,000. No such profit could be expected in this country, the quantity of copper coinage not being so great. But relative to its extent there was no reason why the operation should not leave a profit analogous to that obtained in France. The new copper coinage would not effect any question of the currency or computation; it would leave all such matters exactly as they were; nor would it have anything to do with the decimal system. If we only substitute for the present coins pieces harder, more convenient, and more agreeable, he did not doubt the public would have equal confidence in them. The effect of improving the copper coinage will be to produce a largely increased demand for it. In Paris the increase in the demand after the new coins were issued was 50 per cent. This experience was very encouraging, as a larger demand would be attended by increased profit. The metal proposed to be used for the new coins was bronze; it contained four parts of tin and one part of zinc to 95 parts of copper, which was increased in hardness by the alloy. In reference to this point he should mention that there was a Bill passing through the House, extending the penalties for forging the copper coinage to forging coins of the mixed metal. There was some doubt whether these penalties were incurred by the forging coins of a mixed metal, and as a precaution it had been thought better to introduce the Bill. The new coins would be much lighter than those in present use; the change of metal would enable them to be made much thinner in proportion to their superficies, and their intrinsic value would not be more than half that of the present coins. The quantity of copper now coined into 26 of the old pence would make 45 of the new ones. If the 3,500 tons of the old copper were called in and recoined, the profit would be about £92,000; but if there was an increased demand for the new coin, to the amount of 25 or 30 per cent., that would leave a considerable profit on the operation. One great advantage of the new coin would be its superior durability. The use of bronze was not new to the Mint; the metal had been tried for coinage in Canada and Nova Scotia, and the new issue here would resemble the small coinage adopted in those colonies."

Experiments it is understood have been made with a view to ascertain whether aluminium bronzes would be suitable. It was found, however, that these bronze mixtures, varying from 5 to 10 per cent. of aluminium, tarnished rapidly in wear, and besides being still too costly for adoption.

Home Correspondence.

THE WESTMINSTER CLOCK.

Sir,—It is now more than two years since the controversy between Mr. Denison and myself concerning the Westminster clock and bell appeared in the *Journal of the Society of Arts*, the *Mechanics' Magazine*, *Builder*, and some of the daily newspapers. That controversy, which was commenced in November, 1856, in the newspapers, and continued till April 1857 in the magazines, contained suggestions which would have prevented the principal failures that have since occurred if the Government had acted upon them. Some of the subsequent failures have become public, but the persons responsible for them have ungenerously shifted the blame from their own shoulders on to others. The question of who is responsible for the failures was mooted in the House of Commons on Friday, 15th July, and as no satisfactory answer was elicited, I propose supplying the deficiency to some extent in this and a subsequent letter, and in doing so, perhaps I should claim some credit for forbearance when the first bell was broken, in not then calling attention to the fact of the bell having been destroyed by the clapper, which, throughout the last controversy, I had pointed out as being so enormously heavy compared with the weight of the bell and the size of the clock that was to work the equally disproportionate hammer. A reference to the publications already mentioned will show that the tone in which my statements were contradicted was sufficient to have justified the earliest opportunity being taken of recurring to the subject after events had confirmed my opinions.

The easiest way of arriving at the difference between what the clock was to have been, and what it really is, will perhaps be to go through the excellent conditions originally laid down by the Astronomer Royal for the construction of the clock, and select the chief of those which have not been fulfilled.

The first condition not fulfilled is the one which required the wheels to be made of hard gun-metal, with the teeth cut to the epicycloidal form. Instead of this the wheels have been made of cast-iron, which is the cheapest material that could be used, and the teeth have been cast in, instead of being cut, whilst a large sum has been added in the contract for the change, under the plea of the extra labour required in cutting and working cast-iron; whereas it now appears that the wheels are destitute of the promised workmanship, and that they are merely left from the casting. These deviations have been effected at Mr. Denison's instigation, and he is the person responsible for them.

A second condition required the escapement to be the dead beat, or something equally accurate. Instead of this the escapement employed is a modification of the gravity escapement, which in its most perfect form has occasionally been proved to fail even for small astronomical clocks, and as the power in the Westminster clock must of necessity be some hundred of times greater, its employment there is certain to result in failure. For this deviation Mr. Denison is responsible.

A third condition required that the minute hand should move over the half-minute or minute space at once, so as to enable the time to be observed outside within a second. The plan for carrying out this condition has so completely failed that the condition itself has been abandoned. Mr. Denison designed the plan, and is responsible for its failure. The forfeiture of this condition is remarkable, for it is the one concerning which Mr. Denison ridiculed Mr. Vulliamy for hesitating to carry it out.

A fourth condition required that the first blow of each hour should be accurate to a second of time. To fulfil this condition the going part should be capable of keeping time within a second for twenty-four hours at least; but the pendulum is only compensated with zinc; and the enormous surplus force required to drive the hands in all weathers will occasionally reach the escapement and cause it to trip or run forward and the hands to be in error, to the extent of either seconds, minutes, or hours, as the case may be; thus introducing a source of inaccuracy to which gravity escapements are especially liable, and one from which the dead escapement is entirely free. Mr. Denison is responsible for the plan adopted.

A fifth condition required the clock to go and strike eight days with once winding-up. Instead of this the arrangement had failed to the extent of reducing it to a four-day clock, some time since, with the probability of its requiring to be wound up still oftener. For this failure Mr. Denison is responsible.

Another condition appeared in the agreement with Mr. Dent, which required that the clock should be completed and going 12 months in its place to the satisfaction of the Astronomer Royal and Mr. Denison before being paid for; and by finished and going it was of course understood that all the parts of the clock were included, namely, quarter part, hour part, and going part. Yet, notwithstanding this, Mr. Denison gave his certificate, and caused nearly the whole of the contract money to be paid to Mr. Dent's successor more than two years before the clock had been fixed in the building at all, under the plea that the going part alone had been acting satisfactorily in Mr. Dent's shop waiting for the bells; but this was without either the hands or the motion work, or the hour and quarter parts being attached, and under none of the disadvantages of strong winds, snow, and frost, which will exert considerable influence upon them when at their great elevation. In fact to have taken the trial in Mr. Dent's shop as the test of what the clock was capable of doing, was like trying a locomotive for its power without attaching any train to it, and taking the speed it was able to attain as the result which might be expected when encumbered with its compliment of carriages.

The last failure publicly announced is the extreme weight of the minute hands, which the first Commissioner of works has stated in the House of Commons to weigh more than 3 cwt. each. This weight for a minute-hand of only 11 feet radius is incomprehensible, even when allowance is made for the fatality which seems inseparable from the Westminster clock. Instead of 3 cwt. the hands should not have weighed 1 cwt. each, and if the metal had been disposed in the best form for giving the greatest strength with the least weight, they would have been amply strong enough with considerably less than 1 cwt. of metal in each. The first Commissioner of Works added that lighter hands were about to be made, and that it was probable the clock would then work all the four dials in a satisfactory manner. But this anticipation, like others of the past, will certainly be disappointed, for, after computing the weight which suitable hands, counterpoises, motion work, &c., must necessarily amount to for four dials of this size, and allowing for the additional influence of high wind, frost and snow, the force required to overcome the whole will be so great compared with the weight of the pendulum, and the small force, which will be capable of disturbing its time, that there does not appear to me any possibility of the clock maintaining a constant rate within several seconds a day, even though a dead escapement should be substituted for the gravity escapement to prevent tripping, and supposing the clock can be made to go continually thereby. And considering further that other sources of error will prevent the pendulum being increased so as to meet the difficulty, I am quite convinced that a clock with four dials this size can only be made to keep a rate within a second a day, by a similar plan to the one patented by myself, which I submitted to the Astronomer Royal for adoption in the Westminster clock several years ago, but Mr. Denison had then so far usurped the control over the clock as to prevent any plans being adopted besides his own. In this plan the power employed to drive the hands is completely cut off from the escapement and pendulum which regulate the time, and a small astronomical clock, with all its accuracy and durability, is employed for the time-keeping part, whilst the power available in the large clock for driving the hands, may fluctuate even to the extent of 100 lbs. at the diameter of the centre wheel without affecting the time half a second a day. The plan, moreover, allows the Astronomer Royal's condition to be easily fulfilled for enabling the time to be observed to a second by the exterior minute hands moving quickly over the space of 14 inches once a minute.

The difficulty that was likely to occur from Mr. Denison's plan of regulating the going part by a gravity escapement in direct communication with the hand train, was pointed out to the late Commissioner of Works last February, and in the same letter I offered to undertake the superintendence of the clock, in order to introduce the improvement just mentioned and carry it to successful completion, but the reply seemed to indicate that the Board had not then power to change the superintendence. In fact, Mr. Denison boasted in his book, nearly two years ago, that the Board had taken no less than five opinions from the Attorney-General, the Solicitor-General, and the other law officers of the Crown, to try and "get rid" of his superintendence without being able to do so, and the parliamentary papers show that the law officers were consulted with that object in view.

Concerning the cost of the clock, a great deal of credit has been claimed for the lowness of Mr. Dent's tender, as compared with those of Vulliamy and Whitehurst, and the difference between them has formed one of the principal reasons for giving the contract to Mr. Dent; but we now see that the clock once secured, with Mr. Denison as referee, all idea appears to have ceased of its being carried out according to the original conditions, upon which the others tendered, and a much easier way is adopted of making up for the low tender. Mr. Denison, having fairly established himself in the double position of designer and referee, acting professedly for the Government, begins the process by causing the material to be altered from expensive gun-metal to cast-iron, and the contract price, instead of being lowered, to be raised from £1,600 to £1,900, partly under the plea of iron being more expensive to work; and then the next step is to dispense with the said workmanship altogether, but retain the full price in the contract, thus evading not only the original workmanship which gun-metal wheels would have necessitated, but the additional labour of cast-iron, for which the extra sum was added. And then as each failure occurs in the plans of Mr. Denison, the designer and the Astronomer Royal's conditions of construction are sacrificed after each other. Mr. Denison the referee is ever ready to put a bold face on the matter and pronounce the sacrifice of the conditions as really the best thing that could have happened, and modestly intimates that the Government is fortunate in having the man "who understands the subject better than any one else in England." Mr. Dent's original estimate for the entire clock was, as we have seen, £1,600, but what the sum may have reached under Mr. Denison's management, now that the principal advantages of the clock have been sacrificed, there is no available evidence at present to show.

Having briefly sketched the failures that have occurred and those which are likely to follow, with regard to the clock, and shown who is responsible for them, I purpose giving a smilar sketch concerning the bells in my second letter.

Yours, &c.,
E. T. LOSEBY.

30th July, 1859.

COLONISATION OF BRITISH INDIA.

42, Basinghall-street, 11th August, 1859.

Sir,—I beg to communicate to you the following extract from the last despatch from Darjeeling, dated 31st May, as it is of great interest to intending settlers, who may address Frederick Brine, Esq., Hope Town, Darjeeling.

I am, &c.,
HYDE CLARKE.
Agent for British settlers in Darjeeling.

"Our memorial to the Bengal and Supreme Governments was forwarded three or four days ago to Mr. O'Donnell. I send you a copy of it. It contained the signatures of nearly all Darjeeling, including that of the Maharajah of Budwan, and will be signed in Calcutta by all those who are interested in land in Darjeeling. Copies of our former memorial, and of Lord Stanley's reply, and of your letter to Lord Stanley, have been forwarded with the present memorials.

"The Darjeeling Land Rules are out, and I send you a copy of them. Land can now be purchased in fee simple for 10 rupees per acre, payable in ten years, at one rupee per annum. Capitalists who wish to come out from England and invest in land, should lose no time, as large applications are coming in from Calcutta.

"I shall be happy to supply information to intending emigrants, and I shall be able to recommend to capitalists who come out respectable and trustworthy assistants, experienced in the language and customs of the country. Such assistance will be in requisition. My residence, uninterrupted, of 28 years in India has made me acquainted with a large circle of practical honest men, and I know many who would be glad of obtaining appointments in the hills for the sake of the climate.

(Signed) "FRED. BRINE, Hon. Sec."

RULES FOR THE GRANT OF WASTE LANDS IN DARJEELING TERRITORY.

1. Grants of waste land in the Darjeeling territory shall be sold by auction, at an upset price of 10 rupees an acre.

2. Sales of grants of waste lands shall be made from time to time at the office of the superintendent of Darjeeling, on application for that purpose by intending purchasers, in such manner and under such rules as may be laid down for that purpose by the Board of Revenue, full and sufficient notice of the day of sale and other needful particulars being given to the public; should it in any case be deemed inexpedient to grant the land applied for, the superintendent shall refer such case, with his reasons for deeming the grant inexpedient, for the orders of the Board.

3. Every grant proposed to be sold shall first have its boundary cleared and its area determined by an officer appointed for that purpose by the superintendent.

4. No grant shall be of less than fifty acres.

5. A purchaser at auction, of such grant or grants, shall make a deposit, at the time of purchase, of ten per cent. on the amount of purchase money.

6. The balance of the purchase-money shall be paid in annual instalments of ten per cent. on the amount of purchase-money, and in default of such payment the sale shall be considered void, the deposit and any prior payments of instalments being forfeited to Government, and the Government shall be at liberty to re-sell the land on its own account.

7. The Government reserves to itself the right of making and constructing such roads and bridges as may be necessary for public purposes in all lands purchased as above, and also of such indigenous timber, stone, and other materials as may be required for making and keeping the said roads and bridges in repair. Land taken for these purposes shall be paid for at the rates at which it was purchased, by refund of the money paid for it; and compensation shall be granted, when claimed for any damage done to the plantation in the construction of the works.

8. The sale shall convey a title to all mines and minerals within the limits of the grant sold; but a tax not exceeding ten per cent. on the gross produce of such mines and minerals shall be levied by the Government in such manner and under such rules as may hereafter from time to time be determined on.

9. Existing grants may be commuted under these rules at the option of the grantees.

Proceedings of Institutions.

Leicester Church of England Institute.—In the first Report of this Institute, which has only existed since April 1858, the Committee say that they have good reason to be satisfied with the progress which it has already made. What has already been effected encourages the hope that the object for which the Institute was set on foot—namely, to exercise a salutary influence over the young men of Leicester and of its vicinity, may be ultimately secured. The Evening Classes for instruction, which several gentlemen have so kindly undertaken to conduct, have been fairly attended, and, as it is hoped the sequel will show, are steadily and unostentatiously doing their work. No lectures have as yet been delivered; not that the Committee underrate this mode of instruction, but that they feel assured that however useful lectures may be, as conveying general notions of any science or pursuit, all real solid information can be gained only through the medium of classes and of private application. Still they have it in contemplation to make arrangements for the delivery of lectures from time to time, as shall seem most expedient. A commodious house, well adapted to the purposes of the Society, containing a lofty and spacious Reading-room, a Library, and Class and Chess-rooms has been engaged. A room is set apart for the accommodation of the clergy and other senior members, especially those not residing in the town, as a place in which to transact business, write letters, or wait for appointments. The chess-room will also be granted during the morning and afternoon of any day as a place for Committee Meetings of Societies connected with the Church of England, of which the want has long been felt.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 30th July and 1st August, 1859.

82. Bills—Weights and Measures Act Amendment—(Amended).
83. ,, Charitable and Provident Societies.
84. ,, Coinage.
85. ,, Stamp Duties.
86. ,, Probates and Letters of Administration (Ireland).
87. ,, Reserve Volunteer Force of Seamen.
88. ,, Government of India Act Amendment.
78. ,, Dublin Police.
89. ,, Endowed Schools (as amended by the Select Committee).
90. ,, Sale of Gas.
91. ,, Fireworks Act Amendment (Amended).
92. ,, Turnpike Trusts Arrangements.
93. ,, Turnpike Acts Continuance.
94. ,, Customs.
95. ,, Court of Probate, &c. (Acquisition of Site) (No. 2).
96. ,, Sessional Divisions.

Prussia—Further Despatch from Lord John Russell to Lord Bloomfield.
Public Works (Ireland)—27th Report.
Militia of the United Kingdom—Report of the Commissioners.
Abolition of Turnpike Gates and Toll Bars—Report of the Commissioners.

Delivered on 2nd August, 1859.

102. Printed Papers (presented by Command)—Return.
97. Bills—Customs (No. 2).
98. ,, Chester and Holyhead Railway, at Holyhead.
99. ,, Poor Law Boards (Payment of Debts) (amended by the Select Committee).

Delivered on 3rd August, 1859.

119. Income Tax—Return.
128. St. Marylebone, &c., Workhouses—Return.
100. Bills—University and College Estates' Act (1858) Amendment.
102. ,, Metropolitan Police.
103. ,, Chief Superintendent, China.
104. ,, North Western Territories (British America).
105. ,, Speaker of the Legislative Council (Canada).
106. ,, Police (Counties and Boroughs) (Amended).

Delivered on 4th August, 1859.

123. Polytechnic Accident, &c.—Return.
136. William Henry Barber—Copy of Memorial.
101. Bills—Militia Laws Amendment.
107. ,, Divorce Court.
108. ,, Superannuation Act Amendment.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August* 12*th*, 1859.]

Dated 23rd June, 1859.

1507. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in machinery for the manufacture of bolts and rivets. (A com.)

Dated 16th July, 1859.

1682. J. Bernard, Albany, Piccadilly—Certain imp. in the manufacture of boots and shoes, and in the machinery or apparatus to be employed therein.

1686. O. Grimshaw, Belfast—Imp. in safety letter boxes or bags.

Dated 20th July, 1859.

1706. W. J. and D. Gradwell, Manchester—Certain imp. in bearings or journals employed in machinery, which improvements are also applicable to the bearings of railway and other wheels and axles.

Dated 21st July, 1859.

1714. C. Tapp and J. B. Tapp, Chesterfield, Derbyshire—Imp. applicable to steam boilers and furnaces for consuming smoke and economising fuel in the generation of steam, and in the apparatus connected therewith.

Dated 26th July, 1859.

1734. W. H. Buckland, Maesteg Iron Works, Glamorganshire—An improved preparation of peat.

1736. P. D. Mickles, Syracuse, New York, U.S.—An improved spring for railroad and other carriages, and for other uses and applications where springs are required. (A com.)

1737. J. Hinks and G. Wells, Birmingham—An imp. in, or a substitute for, the hook of the ordinary hook and eye dress fastening.

1738. J. Gillott and J. Morrison, Birmingham—New or improved machinery for the manufacture of the handles of penholders, which machinery or a part or parts thereof may also be employed for manufacturing other cylindrical articles.

Dated 27th July, 1859.

1740. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved comb-cleaner. (A com.)

1742. J. Davies, Tetbury, Gloucestershire—A new or improved self-adjusting ventilating apparatus.

1744. J. Scoffern, 4, Barnard's Inn, Middlesex—Imp. in waterproofing, cementing, and stiffening fabrics and fibrous materials, and also in dyeing fabrics and fibrous materials.

Dated 28th July, 1859.

1746. W. Hudson and C. Catlow, Burnley, Lancashire—Certain imp. in looms for weaving.

1747. E. Hunt and H. D. Pochin, Salford—Improved resin and resinous substances.

1748. A. Sidebottom, Crown-street, Camberwell, Surrey—Imp. in the mode or process of separating animal fibre from mixed fabrics of animal fibre and cotton or other vegetable fibre.

1749. C. W. Smith, Evans, New York—Imp. in electric telegraphs, and in the apparatus connected therewith.

1750. W. Kent, Paternoster-row—A self-acting fan.

1751. J. W. D. Brown, Lewisham, Kent—Imp. in signal and light-house lamps and lanterns.

1753. W. E. Newton, 66, Chancery-lane—Imp. in grinding mills. (A com.)

1754. W. Clark, 53, Chancery-lane—Improved apparatus for turning over music leaves or sheets. (A com.)

1755. J. Jackson, Church street, Spitalfields—Imp. in metal pens.

1756. P. Robertson, Sun-court, Cornhill—Imp. in the manufacture of beer, ale, porter, and spirits.

Dated 29th July, 1859.

1757. T. Culpin, 25, Royal Hill, Greenwich—Imp. in water-closets, water-cisterns, urinals, baths, lavatories, and other sanitary apparatus, and in the mode of supplying water thereto.

1758. I. M. Lindley, Staley bridge, Chester—Imp. in cop-tubes.

1759. J. Wright, 42, Bridge-street, Blackfriars—An improved method of raising or drawing up the skirts of gowns or dresses. (A com.)

1761. P. A. Viette. 25, Faubourg de Shaerbeek, near Brussels—Imp. in engraving on metal or on other substances decomposable by acids or corrosive salts.

1762. J. Chandler, Deptford—Imp. in apparatuses for indicating the water level in boilers, and other vessels, parts of which are also applicable for inspecting the interior thereof.

1763. T. J. Terrell, Poplar—An imp. in ships, riding bits, and timber heads.

1764. A. V. Newton, 66, Chancery-lane—Certain imp. in that class of fire-arms known as revolvers, and in bullets for the same. (A com.)

Dated 30th July, 1859.

1765. J. Wood, York City—An improved truss for hernia.

1767. G. Gurney, Woodleigh, Cornwall—Imp. in electric telegraph conductors.

1769. T. Firth, Sheffield—An improved breech-loading cannon.

1771. A. B. Wilson, Cockermouth—Imp. in the manufacture of hats.

1773. P. M. Parsons, Arthur-street West, London-bridge—Imp. in switches and crossings of railways.

Dated 1st August, 1859.

1775. J. Mollady, Manchester—An improved form or construction of hat, cap, or covering for the head.

1777. T. G. Messenger, High-street, Loughborough, Leicestershire—Imp. in the construction of buildings or erections to be used for horticultural or other purposes.

1779. J. Rowland, Salisbury—An improved apparatus for mashing and mixing.

1781. W. E. Newton, 66, Chancery-lane—An imp. applicable to salinometer cases for steam boilers. (A com.)

Dated 2nd August, 1859.

1783. J. C. Ashwell, Dorchester street, New North road—Imp. in wheels for railway and other carriages.

1785. H. Olorenshaw, Coventry—An imp. in neck-ties.

Invention with Complete Specification Filed.

1840. G. T. Bousfield, Loughborough-park, Brixton, Surrey—A new and useful method of manufacturing the vulcanized compounds of vulcanizable gums. (A com.)—9th August, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, August* 12*th*, 1859.]

August 12*th*.

408. J. Parkinson.
410. C. Sanders.
414. R. Clegg, F. Angerstein, and J W. Page.
420. W. Raymond.
421. J. Paterson.
423. G. Bedson.
426. S. Bailey.
428. C. E. Wright.
446. T. Cattell.
447. F. W. Emerson.
448. C. Fay.
461. W. Clay.
452. W. Basford.
464. C. F. Vasserot.
467. F. P. J. Van den Ouwelant.
469. O. Blake.
471. T. Wilson.
475. R. Jobson.
477. R. W. Johnson and W. Stableford.
490. S. Ridge.
507. E. Price and E. Hawkins.
514. R. Fielden, jun., and T. Fielden.
520. J. Lee.
528. G. Horner.
539. Rev. H. Moule.
547. P. Currie.
557. J. H. Johnson.
584. W. P. Savage.
585. F. Verdeil and E. Michel.
604. C. Mills.
665. J. M. Denys.
704. W. and S. Pickstone.
739. J. Evans.
768. M. A. Muir and J. Mc Ilwham.
811. W. E. Newton.
867. R. Postlethwaite.
896. H. F. Gardner.
908. W. H. Barlow.
1033. T. A. Weston.
1098. J. Childs.
1124. J. Scholfield and W. Cudworth.
1194. W. Warne, J. A. Fanshawe, J. A. Jaques, and T. Galpin.
1249. G. R. Sampson.
1258. T. S. Cressey.
1265. J. H. Mason and G. L. Baxter.
1272. N. S. Dodge.
1274. N. S. Dodge.
1286. M. A. F. Mennons.
1299. J. Reynolds.
1302. J. Young.
1375. E. Gill.
1400. A. V. Newton.
1415. J. James.
1448. C. Wilkinson.
1453. E. A. Cutler.

[*From Gazette, August* 16*th*, 1859.]

August 16*th*.

474. P. Spence.
478. J. Schloss.
485. E. Lund.
486. R. A. Brooman.
488. W. Gossage.
491. W. Ashton.
493. U. Scott.
495. S. R. Samuels.
498. H. B. Barlow.
503. J. Crosland.
504. A. Lançon, junr.
575. J. Cowban and E. Andrews.
586. G. Leach.
598. J. P. Clarke.
643. T. Lightfoot.
655. J. Dixon and R. Clayton.
770. B. Smith and C. L. Smith.
1189. D. Foxwell.
1275. A. V. Newton.
1392. R. R. Fairgrieve and S. Bathgate.
1394. J. Henderson, W. Henderson, T. Bagley, and S. Holdsworth.
1428. A. V. Newton.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, August* 12*th*, 1859.]

August 8*th*.

1881. A. L. Reid.

[*From Gazette, August* 16*th*, 1859.]

August 11*th*.

1900. A. Priest and W. Woolnough.

August 12*th*.

1899. E. Hallen and W. H. Kingston.
1917. J. W. D. Brown and G. G. Brown.
1952. J. Crossley and J. Bolton.
1988. E. A. Cowper.

Journal of the Society of Arts.

FRIDAY, AUGUST 26, 1859.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

EXAMINATION PAPERS, 1859.

(*Continued from page* 638.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

CHEMISTRY.

THREE HOURS ALLOWED.

No candidate is to answer more than three questions in each division.

First Division.

(1.) How are mercury thermometers made? How graduated according to the Fahrenheit scale? What are their chief defects?

(2.) Describe an apparatus for estimating the quantity of heat evolved in the combustion of coal.

(3.) What weight of boiling water is needed to melt a pound of ice without raising its temperature?

(4.) A lamp is capable of throwing as strong a shadow upon a screen at three yards distance as a taper at one yard distance. How much stronger is the light from the lamp than that from the taper?

(5.) Describe the construction and use of the voltameter.

(6.) Describe and explain the electrotype process?

Second Division.

(1.) Describe the preparation and properties of the compounds of nitrogen and oxygen?

(2.) Describe the preparation of some of the commonest salts of ammonia, and their uses?

(3.) Describe the preparation and chief properties of lamp black, animal charcoal, wood charcoal, and coke?

(4.) Describe the preparation and characteristic tests of prussic acid?

(5.) What weight of clorine is evolved by heating a pound of pure binoxide of manganese with an excess of hydrochloric acid?

(6.) Describe the compounds of sulphur and carbon, their chief compounds and decompositions.

Third Division.

(1.) How is mercury detected in presence of other metals? How separated from them?

(2.) Explain the preparation and purification of metallic antimony?

(3.) Describe and explain the process of copper-smelting?

(4.) Explain the preparation, properties, and composition, of the chief compounds of lead used as paint?

(5.) How much metallic silver is contained in an ounce of the nitrate?

(6.) How is phosphoric acid detected in presence of alumina?

Fourth Division.

(1.) How is cane-sugar prepared from the cane? How refined?

(2.) Explain the preparation of oil of bitter almonds, and describe its purification?

(3.) How is benzole prepared from coal tar? And what are its chief properties and uses?

(4.) How is glycerine prepared from fats? And in what proportions does it combine with acids?

(5.) How is acetone distinguished from alcohol?

(6.) Describe the preparation, composition, and chief salts of nicotine?

ANIMAL PHYSIOLOGY.

THREE HOURS ALLOWED.

N.B.—The Candidate may choose such questions from this paper as he judges he can satisfactorily answer within the time allowed; it being understood that value will be given for the fulness as well as the number of the answers, provided they are to the point.

(1.) Describe the principal differences in the shape, structure, and arrangement of the teeth, and in the mechanism of the jaws, in mammiferous animals; and point out the adaptation of the same to the nature of the food and mode of feeding, in different instances.

(2.) Give an outline of the structure of the heart, of the general arrangement of the blood-vessels and the mode of circulation of the blood in a warm-blooded animal, and point out the differences in the circulating organs and in the course of the blood in a fish.

(3.) State the nature of the cutaneous perspiration, the circumstances which increase or diminish its quantity, and the purposes served by its discharge.

(4.) What changes take place respectively in the air and in the blood in respiration? Explain how that process contributes to maintain animal heat; and mention any facts observable in the economy of different kinds of animals, or of the same animal in different circumstances, which show a connexion between respiration and animal temperature.

(5.) Describe the structure of a nerve. State what distinction there is among the nerve-fibres as to function. Where may functionally different nerve-fibres be found associated in the same cords, and where are they separate? How may the difference in function be proved?

6.) Give examples of absorption in the animal body, both of extraneous matters and of its own substance. By what vessels is the absorbed matter conveyed? What explanation can be given of the mechanism of the process, and what remedial suggestions does a knowledge of absorption afford in the case of bites or stings of venomous animals or of wounds from poisoned weapons?

(7.) Give an outline of the structure of the eyeball and explain the mode in which images of external objects are formed on the retina.

(8.) Give a brief history of the changes which take place in the egg of the common fowl during incubation; comprehending an outline of the development of the several parts of the embryo up to the end of the third day, and an account of the membranes enveloping or attached to the chick and of their functions, to the end of the full period.

(9.) Give examples of larval metamorphosis—one from the vertebrata and two or more from the invertebrata—and describe briefly the process in the several cases.

(10.) State the chief circumstances in respect of organization and functional economy, in which the marsupials differ from other mammalia.

BOTANY.

THREE HOURS ALLOWED.

The Candidate is not to answer in all more than twelve questions, which may be selected at will from the two Sections.

Section I. (for Competency.)

(1.) Enumerate the organs found on a perfect flowering plant.

(2.) Describe the most important diversities of form of leaves.

(3.) Name the principal forms assumed by stems of plants living more than one season.

(4.) Explain the difference of structure between a garden Rose and a Dandelion flower.

(5.) Name and give examples of the different relations in which the calyx and ovary stand in flowering plants.

(6.) What difference do we find in the structure of the seeds of wheat, mustard, and onion?

(7.) By what characters can you distinguish Deadly Nightshade and Monkshood from any other native plants?

(8.) Give the character of the order Umbelliferæ.

(9.) Give the character of the order Compositæ.

(10.) How do you know Orchidaceæ from any other native plants?

(11.) Refer the following plants to their respective natural orders, placing them in their respective classes, Dicotyledons and Monocotyledons:—Snowdrop, Parsley, Pink, Dahlia, Honeysuckle, Potato, Mint, Columbine, Flag, Oak, Sycamore, Arbor-Vitæ.

(12.) State what you know of the functions of the different organs of flowering plants.

Section II. (for Proficiency or Excellence.)

(1.) Explain the morphological connection of the organs of flowering plants.

(2.) State the general rules upon which the classification of the forms of leaves is founded.

(3.) Explain the relations of the different forms of the indefinite or centripetal type of inflorescence.

(4.) Give an outline of the general principles of the morphology of flowers.

(5.) Describe the relations of the calyx and ovary in the Saxifragaceæ, Valerianaceæ and Nymphæaceæ.

(6.) Describe minutely the ovule and ripe seed of any plant with which you are acquainted.

(7.) Mention and give the essential characters of the poisonous Umbelliferæ found wild in Britain.

(8.) Name an order which has the following character:—sepals, petals, and stamens 4—5, corolla monopetalous, valvate in æstivation, ovary inferior, 2-celled, 2-seeded, stigmas capitate. Indigenous.

(9.) Name an order which is monœcious or diœcious; perianth free, divided, sometimes in two rows; stamens definite, varying in number, inserted at the base of the perianth; ovary superior, styles 2 or more, or stigmas sessile; fruit dry, 1-seeded, angular; seed erect, with mealy albumen. Indigenous.

(10.) State the differences between Ranunculaceæ, Rosaceæ, Leguminosæ and Rutaceæ

(11.) Name the principal plants cultivated for food in Britain, belonging to the orders:—Cruciferæ, Umbelliferæ, Rosaceæ, Leguminosæ, Compositæ, Liliaceæ, and Graminaceæ.

(12.) Give a brief outline of the principal chemical and physiological phenomena occurring in the growth of ordinary green-leaved plants.

POLITICAL AND SOCIAL ECONOMY.

THREE HOURS ALLOWED.

Each of the four following questions should be answered.

(1.) Define money in general, and also paper-money, and what do you include in the latter term?

(2.) What means exist of estimating the amount both of metallic money and paper money in this country, and what, so far as it can be estimated or ascertained, is the amount of each?

(3.) What are the countries with which this country has the most commerce, and in what articles chiefly with each?

(4.) When and with what object were the navigation laws enacted. When were they repealed, and what are the popular objections to their repeal, and how are those objections answered?

The four following are optional questions.

(1.) When was the Bullion Committee appointed—who were its leading members? What were the questions submitted to it, and how were those questions answered in the report of the committee?

(2.) What addition has been made (so far as it can be estimated) to the stock of gold in the world since the discoveries of that metal in California and Australia, and how do you account for the smallness of the effect hitherto produced upon general prices by those discoveries?

(3.) What was the origin of the land tax and its proportion to the rent of land before the acts passed for its redemption? What was the effect of those acts, and what is the nature of the contract made under them with the land-owner?

(4.) What is the origin of what is called Tenant Right in Ireland, and what questions are raised in reference to that alleged right?

(*To be continued.*)

COMMISSIONERS OF PATENTS—REPORT, 1858.

The Commissioners of Patents appointed under the Patent Law Amendment Act, 1852, (15 and 16 Vict. c. 83.,) in compliance with the terms of the third section of that Act, make the following report of their proceedings under and in pursuance of the same for the year 1858, in continuance of their report of proceedings for 1857.

The number of applications for provisional protection recorded within the year 1858 was 3,007; the number of patents passed thereon was 1,954; the number of specifications filed in pursuance thereof was 1,880; the number of applications lapsed or forfeited, the applicants having neglected to proceed for their patents within the six months of provisional protection, was 1,047.

The Act 16 Vict. c. 5., enacts that all letters patent for inventions to be granted under the provisions of the Patent Law Amendment Act, 1852, shall be made subject to the condition that the same shall be void at the expiration of three years and seven years respectively from the date thereof, unless there be paid, before the expiration of the said three years and seven years respectively, the stamp duties in the schedule thereunto annexed, viz., £50 at the expiration of the third year, and £100 at the expiration of the seventh year.

Two thousand and forty-four patents bear date between the 1st July 1855 and the 30th June 1856; the additional stamp duty of £50 has been paid on 568 of that number; and 1,476 have become void by reason of non-payment.

All the provisional, complete, and final specifications filed in the office upon the patents granted under the Act have been printed and published in continuation, with lithographic outline copies of the drawings accompanying the same, and within three weeks of the respective dates of filing, according to the provisions of the Act 16 and 17 Vic., c. 115.

The provisional specifications filed in the office and lapsed and forfeited, have also been printed and published in continuation.

Printed certified copies of the specifications filed in the office, as also certified copies of patents, and of the record book of assignments of patents and licences, with copies of such assignments and licences, have been sent, in continuation, to the Office of the Director of Chancery in Edinburgh, and the Enrolment Office of the Court of Chancery in Dublin, pursuant to the Act of 1852, and the Act of 16 and 17 Vict., c. 115.

The work of printing the specifications of patents under the old law, 12,977 in number, and dating from 1711 to 1852, having been completed, the Commissioners of Patents have directed short abstracts or abridgments of specifications, grouped under the different heads of invention, to be prepared and published; for example, abridgments of the specifications of patents relating to the propulsion of vessels, commencing in the year 1618 and ending 1857, comprising nearly 1,000 inventions, have been published in three parts, making one small volume.

Abridgments relating to the following subjects of invention have also been published:—Drain tiles and pipes, manufacture of iron and steel (3 parts), manures, sewing and embroidering, preservation of food, aids to locomotion, and steam culture.

Other series are in the press, and it is intended to publish at the rate of six or eight series in each year, completing the work in eight or ten years.

These abridgments are sold at prices a little above the cost of printing and paper.

The following report of the Commissioners of Patents on the subject of the building of a patent office and a public library has been transmitted to Her Majesty's Treasury:—

The 4th section of the said Act enacts, that "it shall be lawful for the Commissioners of Her Majesty's Treasury to provide and appoint from time to time proper places or buildings for an office or offices for the purposes of the said Act."

In pursuance of the requisition of the Lord Commissioners of Her Majesty's Treasury, dated in 1853, the Commissioners of Her Majesty's Board of Works provided certain offices for the Commissioners of Patents, being the ground-floor rooms of the Masters' Offices in Southampton-buildings, Chancery-lane, theretofore occupied by Masters in Chancery, abolished under the Act 15 and 16 Vict., c. 80; and an annual rent of £490 is now paid out of the Fee Fund of the Patent Office to the Suitors' Fund of the Court of Chancery for the hire of the same.

This arrangement was not considered to be permanent; no lease has been granted, and as these offices are now required for the occupation of the registrars and other officers of the Court of Chancery, due notice has been given to the Commissioners of Patents, requiring them to give up possession so soon as other suitable offices can be procured.

These offices were in 1853 sufficient in number and accommodation for the ordinary business of the office.

In the year 1855 the Commissioners of Patents established a free public library within their office, containing works of science in all languages, the publications of the Commissioners, and the works upon patented and other inventions published in the British colonies and in foreign countries.

This library has greatly increased and continues to increase, partly by purchases, but in a great measure by gifts and loans of valuable and useful books. It was resorted to at the first opening by inventors, engineers, and mechanics, as well as by barristers, solicitors, and agents engaged in patent business; it has become a collection of great interest and importance, and the number of readers has gradually so much increased, that at this time convenient standing room cannot be found in the two small rooms within the office which can be appropriated to the library. It is the only library within the United Kingdom in which the public have access not only to the records of the patents and inventions of this country, but also to official and other documents relating to inventions in foreign countries, and this without payment of any fee.

A largely increased accommodation is urgently required.

No suitable building can be found in the immediate neighbourhood of Southampton Buildings, either to be rented or for purchase.

The new offices to be provided must be fire-proof, for the preservation of the original specifications and other records of the office; the offices now occupied are fire-proof throughout.

The Commissioners of Patents are in possession of a collection of very valuable and interesting models of patented machines and implements, as also of portraits of inventors, many of them gifts, and others lent by the owners for exhibition. They are now exhibited daily, and gratuitously, in a portion of the Museum at Kensington assigned to the Commissioners of Patents for that purpose by the Lords of the Committee of Privy Council for Trade.

A museum of this nature necessarily increases, and the number of models now exhibited may be considered as forming only the foundation of a great national museum.

The great work of printing the old specifications of patents, with the drawings attached thereto, enrolled in Chancery under the old law, dating from 1623 to 1852, and 12,977 in number, was commenced in September, 1853, and fully completed in July last (1858). All have been fully indexed in series and subjects, and the indexes printed and published. These prints of specifications form about 900 volumes (450 imperial octavo volumes of drawings, and the like number of imperial octavo volumes of letter press). The indexes form seven imperial octavo volumes.

The cost of these valuable works has necessarily been great, amounting to £92,000.

Notwithstanding this great outlay, the balance sheet of income and expenditure for the year 1857, prepared for the annual report of the Commissioners, and laid before Parliament, shows a surplus income from the commencement of the Act, 1st October, 1852, to the end of 1857, of £6,000.

The balance sheet of income and expenditure for the year 1858, prepared, and shortly to be laid before Parliament, shows a surplus on the year of £5,900, thereby increasing the total surplus to £11,900.

The work of printing the old specifications being completed, as above stated, the expenditure on that head ceases altogether, and consequently the surplus income of the current year (1859) is estimated at £21,600; adding this sum to the present available surplus of £11,900, and leaving a margin of £3,500, £30,000 may be safely estimated as the sum available for building purposes at the end of the current year 1859.

The balance sheet of income and expenditure for the current year 1859 is estimated at, income, £87,300; expenditure, £65,700, shewing a surplus of £21,600.*

The Act of 1853, (16 Vic., c. 5) converted all the fees imposed by the Act of 1852 into stamp duties, thereby passing the whole income of the office to the Consolidated Fund.

The expenditure of the office is estimated and voted annually by Parliament.

There is no appearance of diminution in the number of applications for patents, and they may be safely estimated to continue for future years at 3,000 in each year.

This number will produce £86,000 in stamp duties, and adding thereto £1,300 for the average annual proceeds of sales of printed specifications, the future annual gross income may be taken at £87,300. The gross income is, however, liable to a deduction of £16,300 on account of revenue stamp duties, leaving the real available future income of the patent office at £70,000 per annum, or thereabouts.

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* The details are given in the report.—Ed. *Society of Arts ournal.*

The Patent Law Amendment Act, 1852, (15 and 16 Vict., c. 83.,) imposed certain revenue stamp duties upon patents. These duties have hitherto produced £15,300 per annum, and that sum has been charged against the office in the annual balance sheet of income and expenditure.

These duties are estimated in the balance sheet above set forth for the current year 1859 to produce £16,300 or thereabouts.

The work of printing the old specifications being completed, as above stated, the yearly future cost of the current specifications, abstracts of specifications, journals, indexes, &c., in letter-press printing, lithographic printing, and paper, will not exceed £17,500 per annum, as contrasted with the average yearly expenditure on those three heads of £39,375 within the years 1856-7-8.

The Commissioners of Patents are of opinion that it is not expedient, for the present at least, to propose to Parliament a reduction of the scale of stamp duty fees imposed by the Act of 1852.

They are of opinion that the fees paid upon the passing of a patent are not too heavy; the large number of applications (3,000 in each year) accounting for the large amount of income. Any material reduction in the amount of fees would undoubtedly tend to increase the number of useless and speculative patents; in many instances taken merely for advertising purposes.

The *fee* stamp duties and the revenue stamp duties are as follows:—

	Fee Stamp Duties.	Revenue Stamp Duties.
	£ s. d.	£ s. d.
Within the first six months from the petition for provisional protection to the filing of the specification	20 0 0	5 0 0
On the patent at the expiration of the third year	40 0 0	10 0 0
On the patent at the expiration of the seventh year	80 0 0	20 0 0
(The patent is granted for fourteen years).		

There are 3,000 petitions for provisional protection presented in each year, or thereabouts. Of this number 1,950 reach the patent, and 550 patents pay the £50 additional stamp duty required at the expiration of the third year; 1,450 patents, or nearly three-fourths of the whole, thereby becoming void. Probably not more than 100 of the surviving 550 will pay the £100 additional stamp duty required at the end of the seventh year.

Considering the beneficial results of the additional payment of £50 in sifting useless patents, the Commissioners are of opinion that it is not expedient to reduce the amount, for the present at least, and so long as the surplus can be expended for the benefit of patentees and that portion of the community which is principally interested in and connected with the practical application to public purposes of discoveries and improvements in science and art.

They are of opinion that the surplus income, calculated as before stated, to amount to £30,000 at the end of the current year 1859, and to increase in each succeeding year at the rate of £20,000 per annum, may be beneficially applied in the purchase of ground in a central situation, and in the erection thereon of a sufficiently spacious fireproof building for the patent offices and public free library attached thereto; and that the surplus fund may also be beneficially applied in the purchase of ground and the erection thereon of a permanent and spacious building for the Patent Office Museum. sufficient ground being taken for the extension of the building, from time to time, as may be required.

This is the more necessary inasmuch as models of the most interesting and valuable description lie scattered over the kingdom, in many instances constructed at a great expense, for legal and other purposes, for which the owners have no present use, and many of which occupy a space inconvenient to them. These models, or many of them, would, as the Commissioners confidently expect and believe, be presented or intrusted to them for exhibition in such museum, provided the public are allowed free access to it at all reasonable times.

The patent office is the place of constant, daily, and hourly resort of patentees, agents, and all others concerned in obtaining patents, and in ascertaining what discoveries and improvements have already been made. It should be conveniently placed with reference to the courts of law, the Government offices, and the offices of the attorney and solicitor general.

With respect, however, to the proposed new museum, the Commissioners of Patents are of opinion that the same reasons for a central position do not exist, and that it might be placed upon any spot easily accessible to the inhabitants of the metropolis, and that the place in which the models are now exhibited would be an eligible position, sufficient ground being there purchased or assigned for the purpose. A large space will be required for the building in the first instance, and a larger extent must be provided for its future extension; and sufficient ground cannot be found in the centre of the town for a building of the extent required, unless at an enormous cost.

The Commissioners are anxious to establish a library in conjunction with the museum, showing the patents already granted by foreign governments, and those which from time to time are so granted; and from the facilities afforded by foreign governments the Commissioners have every reason to believe that this may be accomplished without difficulty.

These are the two objects which the Commissioners of Patents present to the consideration of the Lords Commissioners of Her Majesty's Treasury, and for which they are desirous to obtain their sanction:—

1st. The erection of a museum for the preservation and exhibition of the models, as above mentioned.

2nd. The erection of suitable offices.

The latter of these objects ought properly to precede the former; but if the offices they at present hold in Southampton-buildings can be retained for the present, this object may be postponed till a convenient site can be obtained.

For the accomplishment of the former object, a very favourable opportunity at present occurs, as the Lords of the Privy Council constituting the Committee of Trade are (as the Commissioners are informed) willing to allot to them a portion of the land recently purchased at South Kensington, sufficient in extent both for the purpose of the erection of the building now required, and to provide for the future extension of the museum.

The Commissioners of Patents therefore request that the Lords Commissioners of Her Majesty's Treasury will be pleased to sanction the application of a sufficient portion of the surplus now derived from the fees paid on patents for the purpose of accomplishing the objects above mentioned, and that with this view their lordships will be pleased to give the necessary directions to Her Majesty's Board of Works to obtain a proper site for the proposed new Patent Office and Library, to be selected with the approbation of the Commissioners of Patents, and with the sanction of the Lords Commissioners of Her Majesty's Treasury, and also to prepare the necessary plans, elevations, and specifications for this purpose, also to be submitted to the Commissioners of Patents for their approval, and to make contracts for the building of the same when approved.

If their lordships consent to these proposals, the Commissioners of Patents have to request that a sufficient sum for the purpose, so far as the same may be required for the year 1858-9, may be included in the estimate to be laid before Parliament in the present session for Patent Office expenses.

Balance Sheet of Income and Expenditure for the Year 1858.

RECEIPTS.	£	s.	d.
In stamp duties in lieu of fees	83,531	13	6
By sale of prints of specifications, indexes, &c.	1,371	2	0
Surplus income on balance of accounts from the 1st of October 1852 to the end of the year 1857 (Report to Parliament for 1857)	6,005	5	6
	£90,958	1	0

PAYMENTS.	£	s.	d.
Fees to the law officers of England ...	8,235	3	0
Their clerks	748	5	0
Salaries of the officers and clerks in the Patent Office	4,668	15	0
Compensations	4,584	0	0
Current and incidental expenses in the Patent Office	8,742	6	8
Cost of stationery supplied by Her Majesty's Stationery Office, books for the free library, and binding	1,670	0	3
Rent of offices	490	0	0
Messrs. Eyre and Spottiswoode for printing specifications of patents, indexes, &c., and lithographer's bills for drawings accompanying specifications	25,011	8	1
Cost of paper supplied to the printer and lithographer by Her Majesty's Stationery Office	5,644	13	2
Cost of coals and other fuel supplied to the Patent Office by Her Majesty's Office of Works	56	7	0
Expenses incurred in respect of the museum at South Kensington	1,362	6	2
Salaries of clerks for ditto	575	0	0
**Revenue* stamp duty income as below ...	15,350	0	0
Surplus Income	13,819	16	8
	£90,958	1	0

CAMPBELL, C.
JOHN ROMILLY, M. R.
RICHARD BETHELL, A. G.
HENRY S. KEATING, S. G.

Dated the 20th July, 1859.

THE NEW HORTICULTURAL GARDENS AT KENSINGTON-GORE.

Her Majesty's Commissioners for the Exhibition of 1851 having conceded a satisfactory alteration in the claims objected to by the Horticultural Society, the council have passed the following resolution:—"That the terms of her Majesty's Commissioners be accepted as the basis of a lease—and that the society's solicitors be instructed to act for the society in its preparation." It may therefore now be considered certain that the West-end is to have the beautiful garden contemplated. The subscription is reported as going on most satisfactorily, about £28,000 having been already tendered to the council.

ALUMINIUM.*

As respects the soldering of this metal, until very lately quite imperfect results have been attained. In the Universal Exhibition of 1855, there were pieces of aluminium soldered with zinc or with tin, but this weak solder did not give any solidity. Others have tried to solder with alloys of zinc, silver and aluminium. Mr. Denis, of Nancy, has noticed that whenever aluminium and the solder melted over its surface was touched with a slip of zinc, the adhesion took place with great rapidity, as if a peculiar electric action gave it an impulse at the moment of contact; but this solder also has failed to afford much strength.

At last it has been suggested that the difficulty might be surmounted by previously coating the piece with copper, and then soldering together the coppered surfaces. In order to effect this, the aluminium, or at least the parts to be soldered, are plunged into a bath of acid sulphate of copper. The positive pole of the battery is put in direct communication with the bath, and the pieces to be coppered are touched with the negative pole; the deposit of copper takes place very regularly over the surface of the aluminium. These surfaces thus prepared are soldered in the ordinary way.

All these processes are, as is seen, very imperfect, and they now have only a historical interest, on account of a new and perfect method of soldering just discovered. The inventor is a gilder and silverer of metals, belonging to Paris, named Mourey; he has recently announced his process in a public meeting of the Société d'Encouragement. The alloy employed is composed of zinc and aluminium; Mr. Mourey employs five different varieties of it according to the article to be soldered; the composition is as follows:—

	I.	II.	III.	IV.	V.
Zinc,	80	85	88	95	94
Aluminium,	20	15	12	8	6

To prepare it, he melts the aluminium in a crucible of graphite, the metal having been reduced to fragments and added little by little; when the mass is in fusion it is stirred with an iron rod while the zinc is added in small quantites at a time; the alloy is still stirred while a little tallow is added to prevent the oxydation of the zinc, and then it is cast in small ingots. It is important to avoid too high a temperature, lest the zinc should be volatilized. It is also important that the zinc should be free from iron.

These five alloys have different points of fusion. Alloy No. I. is the hardest; the others are softer in regular succession.

As for the manipulation of the solder, this comes under technology. Mr. Mourey has described it in detail; but it would be going too much into specialities for us to cite his account of it, and we subjoin only a few facts interesting in a scientific point of view.

The instrument which is used in the soldering, and which is called in French "fer-à-souder," ought not in soldering aluminium to be either of iron or copper, but

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* The Act of 1852 in lieu of the old duties upon patents imposed a Revenue Stamp duty of £5 upon the warrant of the law officer, £10 upon the certificate of payment of the progressive fee of £40 at the expiration of the third year, and £20 upon the certificate of payment of the fee of £80 at the expiration of the seventh year of the patent.

The Act of 1853 (16 Vict. c. 5.) converted all the fees imposed by the Act 1852 into stamp duties.

The *Revenue* stamp duty account for the year 1858 is as follows:—

	£	s.	d.
1,954 Warrants of the law officers for patents, at £5 each	9,770	0	0
558 Patents on which the progressive duty of £50 has been paid at the end of the third year from their respective dates (£10 being *Revenue* stamp duty and £40 fee stamp duty), 558 at £10 each ...	5,580	0	0
	£15,350	0	0

* *Silliman's Journal.* Correspondence of Professor J. Nicklès.

of aluminium itself; for the soldering alloy adheres to iron or copper in preference to aluminium. The flux used to facilitate the adhesion is made of three parts balsam of copaiba mixed with one part of pure turpentine; the materials are mixed in a porcelain capsule, and a few drops of lemon-juice are added to favour the mixture of the two resins.

This flux is used for thoroughly impregnating the fragments of solder which are to be employed. It is important to use the blow-pipe no longer than is necessary, to prevent loss of zinc from volatilization.

Mr. Gerhard, of Battersea, has also invented a solder for aluminium, which is stated to effect the purpose.

Mr. Gerhard has also found out a means of giving a peculiarly white frosted appearance to this metal, producing a surface superior to anything formerly exhibited. He thus gets rid entirely of that cold blue zinc-like appearance which has hitherto been a drawback to the use of aluminium for ornamental purposes.

As neither of these processes is patented, their manipulation cannot be made public at present.

LONDON DISTRICT TELEGRAPHS.

The report of the London District Telegraph Company, states that of their 12,000 £5 shares 10,740 have been issued, on which a deposit has been received of £1. The formation of the 11 district stations is in progress, and the 89 sub-district stations are expected to be opened by the 1st of January. The lines completed consist of six miles underground and three and a-half miles over-house, and the lines in progress consist of five miles underground and eight miles over-house.

NATIONAL ASSOCIATION FOR THE PROMOTION OF SOCIAL SCIENCE.

President of the Council, the Right Hon. Lord Brougham.

The third annual meeting will take place at Bradford, on Monday, the 10th of October next, and five following days.

President, the Right Hon. the Earl of Shaftesbury; Vice-Presidents, the Mayor of Bradford, Sir John Ramsden, Bart., M.P., the Right Rev. the Bishop of Ripon, Frank Crossley, Esq., M.P.; Presidents of Departments, 1.—Vice-Chancellor Sir W. Page Wood, 2.—Right Hon. C. B. Adderley, M.P., 3.—R. Monckton Milnes, Esq., M.P., 4.—Right Hon. W. Cowper, M.P., 5.—Sir James Kay Shuttleworth, Bart ; General Secretary, G. W. Hastings, Esq.; Treasurer, W. S. Cookson, Esq.; Foreign Secretary, H. G. Bohn, Esq.; Local Secretaries, Rev. J. H. Ryland and R. W. Marsland, Esq.; Local Treasurer, J. V. Godwin, Esq.

All communications concerning papers or other business of the meeting, must be addressed to the General Office, 3, Waterloo-place, Pall-mall, London, S.W. Every paper must be sent to the General Secretary, on or before the 20th of September next. On the first page of every paper must be written the subject, the name of the author, and his address. The Council reserve the right of rejecting any paper which they consider inappropriate. No paper must occupy in reading more than twenty minutes. No paper already published can be read. No paper, when read, can be published by the author (unless by permission of the Council) previous to the publication of the Transactions of the Association for 1859. The Council may print any paper, either in whole or in part, or may exclude it from the Transactions, as they see fit.

First Department.—Jurisprudence and Amendment of the Law.—President, Vice-Chancellor Sir W. Page Wood; Vice-Presidents, H. W. Ripley, Esq., President of the Bradford Chamber of Commerce, and Robert Collier, Esq., Q.C., M.P.; Secretaries, J. Napier Higgins, Esq., and A. Ryland, Esq.; Local Secretary, John Darlington, Esq. In this department is discussed the science of Civil Jurisprudence; its bearing on the social condition of the people; the advantages derivable from a wide diffusion of its principles; the practical defects in our laws; the evils arising from such defects; and the fitting remedies. Papers may be classed under the following heads:—1.—The principles of Jurisprudence and Legislation. Province of Legislation—Adaptation of Law to Social Changes—etc. 2.—The Method of Legislation. The Preparation and Passing of Bills—Minister of Justice—Judicial and Legislative Statistics—etc. 3.—Administration of Justice. Superior and Local Courts—Procedure and Evidence—Professional Regulations—etc. 4.—Laws relating to Property. Mercantile Law—Real Property Law—etc. 5.—Laws relating to Persons.

Second Department.—Education.—President, the Right Hon. C. B. Adderley, M.P.; Vice-Presidents, Rev. J. Burnet, LL.D., Vicar of Bradford, Edwin Chadwick, Esq., C B., and W. E. Forster, Esq.; Secretaries, Rev. G. D. Boyle and Rev. Nash Stephenson; Local Secretaries, Rev. H. J. Burfield, M.A. and Rev. H. B. Creak, M.A. This department deals with the various questions relating to Education, both industrial and intellectual, whether of the upper, middle, or lower classes of society. Papers may be classed under the following heads:—1.—The Objects of Education. 2.—The Means and Methods of Education. University Education—Grammar and Foundation Schools—Competitions for the Civil Service—Middle Class Examinations—Privy Council System—Voluntary System—The Principle of Supporting Schools by Local Rates—Factory Schools—Union Schools—Ragged and Feeding Schools—Agricultural and Industrial Training as an element in School Instruction—Schools of Art—Mechanics' Institutions—etc. [It is proposed, in accordance with a Resolution passed by this Department at Liverpool in October last, to make method in teaching a subject of special treatment.] 3.—The Effects of Education. Better Training of all Classes for their Mutual Duties—Increased Efficiency of Public Services, Professions, etc.—Increased Productive Powers—Saving in Criminal Expenditure, Poor Rates, etc.

Third Department.—Punishment and Reformation.—President, R. Monckton Milnes, Esq., M.P.; Vice-Presidents, E. B. W. Balme, Esq., and Rev. Sydney Turner; Secretary, Martin Ware, Jun., Esq.; Local Secretaries, Rev. J. R. Campbell M.A., and M. W. Thompson, Esq., M.A. In this department are discussed the various questions relating to the prevention and repression of crime; the reformation of the criminal; the best mode of secondary punishment; prison discipline; the management of reformatory schools and institutions, &c. Papers may be classed under the following heads:—1.—Incentives to and Prevention of Crime. Receivers of Stolen Goods—Marine Store Dealers—Beer Houses, and Disorderly Houses. 2.—Criminal Law and Procedure. 3.—Treatment of Adult Offenders. The Convict System—The Prison System—Remunerative Work in Prisons—Public Supervision of Discharged Prisoners—Prisoners' Aid Society—Adult Reformatories. 4.—Treatment of Young Offenders. Reformatory Schools—Ship Reformatories—Reformatory for Incorrigibles—Certified Industrial Schools—Methods of enforcing payment from Parents—Mixing of Criminal and Destitute cases in Refuges—Teaching of Trades in Reformatories and Refuges—Disposal of Boys and Girls on leaving Reformatories.

Fourth Department.—Public Health.—President, The Right Hon. W. Cowper, M.P.; Vice-Presidents, H. W. Wickham, Esq., M.P., J. Simon, Esq., F.R.S., and T. Southwood Smith, M.D.; Secretaries, W. Farr, M.D., F.R.S., and Philip H. Holland, Esq.; Local Secretaries, Dr. Macturk and H. F. Lockwood, Esq. This department considers the various questions relating to the public health; it will collect statistical evidence of the relative healthiness of different localities, of different industrial occupations, and generally of the influence of external circumstances in the production of health or disease: it will discuss improvements in house-construction (more especially as to the dwellings of the labouring classes), in drainage, warming, ventilation; public baths and wash-houses; adulteration of food and its effects; the functions of government in relation to public health, the legislative and administrative machinery expedient for its preservation; sanitary police, quarantine, &c.; poverty in relation to disease, and the effect of unhealthiness on the prosperity of places and nations. Papers may be classed under the following heads:—1.—The Condition of the Public Health. The subjects, chiefly statistical, referred to this head, will comprise everything that relates to the past or present state of the Public Health. Papers descriptive of the general state of health of particular districts, or of the same districts at different periods, or under different circumstances, and of persons engaged in the several industrial occupations, as well as of the special diseases to which particular localities, and modes of life or of occupation, are most liable; will be classed under this division. 2.—The Causes which modify the Public Health. To this head will be referred papers that treat of the causes which, whether favourably or injuriously, affect the Public Health, and the mode in which these causes act. This division will thus include the consideration of the production of disease by external causes to which persons, either individually or collectively, are liable to be exposed; such as climate, soil, locality, habitation, diet, occupation, station, or habit. 3.—The Improvement of the Public Health. Communications that suggest plans for the amendment of the Public Health, whether these have reference to legislative enactments, and the machinery requisite for the administration of sanitary law; to the removal of causes of disease by engineering or other mechanical appliances; or to the prevention of disease by hygienic precautions, will be classed under this head. 4.—Social and Economical Aspects of Public Health. This division will include inquiry into the effect of diminished death-rates upon the Population—the effect of Sanitary Improvement on the National Wealth, the Diminution of Pauperism, and the general Moral and Physical Elevation of the Community.

Fifth Department.—Social Economy.—President, Sir James Kay Shuttleworth, Bart.; Vice-Presidents, E. Akroyd, Esq. and Titus Salt, Esq., M.P.; Secretary, Professor John Wilson; Local Secretaries, Rev. J. P. Chown, and George Wood, Esq., M.P. In this department are considered the various questions relating to Social Economics; the conditions of Industrial Success, whether of nations or individuals; the relation between employers and employed; strikes and combinations; legislative interference with the hours and wages of labour; legislative regulation of professions, trades, and employment generally, and of price and means of supply; emigration, its effect, and true conditions; industrial employment of women; industrial and economical instruction of the labouring classes; public amusements; social economics in relation to education; exercises of public and private charity; relief of the poor. Papers may be classed under the following heads:—1.—Conditions of Industrial Success. Accumulation and Employment of Capital—Freedom of Trade—Apprenticeship System—Trades' Unions—The effects of Science and Machinery on Industrial Success—The Factory System—etc. 2.—Condition of the Working Classes. Habitation—Domestic Economy—Provident Habits—Recreation—etc. 3.—Charity and Relief. The effects of Charitable Endowments — Workhouse Relief and Management—etc. It is considered desirable that one or two papers in this department should be devoted to the more abstract questions of Economic Science; to generalizations of ascertained facts, and enunciation of the laws to be deduced from them. [The following special question has been proposed for the consideration of this department at the Bradford meeting:—How far, and in what way, can the National Census of 1861 be made available for procuring information on the moral, material, and social condition of the country?]

DISINFECTION OF SEWAGE.

The following letter, addressed to the Editor of the *Daily News*, gives the result of some experiments on M'Dougall's disinfecting powder, an account of which appeared in the Paper read before the Society by Dr. R. Angus Smith, F.R.S. (See *Journal*, Vol. V., p. 353):—

Sir,—The present state of the Thames has become so dangerous to the whole community, that it has for some time drawn the attention of the authorities to the consideration of some plan by which its action may be prevented. Hence experiments have been made with various disinfectants, at the request of the Metropolitan Board of Works, by Professor Miller, of King's College. What the results are at which he has arrived I have no exact means of knowing, but having for years experimented with various disinfectants, and having drawn the attention of the public to the effects produced—(you yourself having once granted me the use of your valuable space for the purpose)—I would ask your consent to publish my experience upon the sewage in the present year.

It may be as well to state that my results last year were so entirely in favour of the disinfectant of Messrs. Smith and M'Dougall, of Manchester, that I was induced, early in the present year, to repeat them. I again found that sewage of the worst description, emitting the most deleterious gases, could be rendered perfectly sweet and harmless, emitting only the odour of the impure coal-kreosote (carbolic acid) which forms the important feature of Dr. Smith's invention. Whenever a sufficient quantity of the disinfecting powder was employed, I found that sewage precipitated in May was perfectly free from sewage odours in July; and sewage deposit, which is the worst part of sewage, when similarly dealt with, remains to this day equally beneficially effected. Comparing these results with those I published last year; and especially comparing the disinfected specimens with one which I have had these three years (last June) in my possession, and finding the results perfectly in concordance, it cannot be wondered that the patentees, with a knowledge of these facts, should have desired me to make notes of any experiments which might be made under the direction of the Board of Works. Accordingly, I have done so, and subjoin such results as I have arrived at. According to Dr. Miller's suggestion, Mr. M'Dougall employed a portion only of his patent, viz., that which embraces the use of carbolic acid and lime. Although I am of opinion that these include the most valuable part of Dr. Smith's discovery, yet I cannot but think that the whole patent, which involves the additional employment of sulphate of lime and magnesia, is better suited to effect the object, viz., prevention of the decomposition of both animal and vegetable matter. However this may be, the results of the large experiment on the Tottenham-court-road sewer are sufficiently satisfactory to warrant a similar application to the Thames.

The quantity of carbolic acid employed in the above sewer averaged 685 lbs. (at 6s. 6d. per cwt.) per day, together with 70 lbs. of lime and 12,000 gallons of water. On the hottest days, a larger amount appeared necessary, as I judge from the results; at least this is certain, that when another cwt. or so was employed in excess of the above 685 lbs., the sewage bore the highest temperature to which it could ever be exposed under the highest conceivable solar influences, continued for six days, without evolution either of sulphuretted hydrogen or any other foul emanation.

I will not ask you to publish each experiment, but will merely record that the clear amber-coloured solution of carbolate of lime was churned by paddles into an opening in the sewer in Tottenham-court-road, and that the specimens examined by me were the precise counterparts of those which Dr. Miller received.

The conclusions I arrived at were, that it was quite within the reach of possibility to prevent altogether the evolution of nauseous gases from London sewage, and not difficult to disinfect the Thames. But if price is a consideration, I cannot understand how any other disinfectant can be employed. The experiments made with chloride of lime distinctly indicate that, unless in actual excess, which would involve six times the outlay, the sewage becomes almost as bad as before its addition. Effective, too, as is Cundy's, a similar objection applies both as to price and continuous results. If, then, as I am entitled to conclude from very many experiments, it is possible to prevent the Thames from continuing, year after year, the most dangerous nuisance, by the judicious application of Messrs. M'Dougall's disinfectant, it becomes simply a question of proportions and price. The latter I would not attempt to fix, as my data are at present insufficient; but the proportions admit of scientific calculation. The mode of appliance is fortunately at hand. Not contented with disinfecting the sewage, we must at once direct attention to the Thames. By diffusing the disinfectant with the aid of the paddles of the numerous steamers which are constantly stirring up the mud of the river, we have a method which would ensure complete success in purification in the course of a week.

But whether or not such a plan be adopted, no effectual good can be done by driblets. The expenditure of £1,500 per week in lime and chloride of lime at the mouths of the sewers is perfectly useless, and will accomplish nothing towards preventing the rise of deadly miasmata from the body of the river.

I am, &c.,
ALBERT J. BERNAYS,
Lecturer on Chemistry at St. Mary's
Hospital, Paddington.

SALE OF GAS.

Below is given a short abstract of a bill for regulating the sale of gas, which received the royal assent on the last day of the session of Parliament.

It is a matter of notoriety that, owing to the absence of any legal control, or supervision in the matter, there have been constant wranglings between the gas consumers and the gas companies throughout the kingdom on the subject of measurement, many of the former complaining that they have been charged largely in excess of the quantity actually used, while not a few of the companies on their part have not unfrequently charged their customers with tampering with their respective meters. Seeing, therefore, that the design of this Act is to prevent, so far as such matters are preventible, the recurrence of these inaccuracies and disputes, and seeing also that the sum paid for gas in this country is said to amount to £5,000,000 sterling annually, it is evident that this Act is one of vast practical importance to all who have to do with this commodity, whether as buyers or sellers.

After the passing of this Act the only legal standard or unit of measure for the sale of gas by meter shall be the cube foot, containing 62·321 lb. avoirdupois weight of distilled or rain water, weighed in air at the temperature of 62 degrees of Fahrenheit's thermometer, the barometer being at 30 inches; except as relates to contracts made before the passing of this Act, by which a difference of unit of measure is adopted, which contracts may not be renewed. The models of measures are to be made and verified under the direction of the Treasury, and afterwards to be deposited in the office of the Controller-General of the Exchequer at Westminster, and copies of the same are to be sent to the Lord Mayor of London, the chief magistrates of Edinburgh and Dublin, and to the chief magistrates of such other cities and boroughs, and to such other places and persons in Her Majesty's dominions, as the Lord High Treasurer of Her Majesty's Treasury may from time to time direct. The number and sizes of the said models to be decided within nine months from the passing of this Act in England by order of general or quarter sessions, excepting in the case of boroughs where the order shall be made by the town council, and in Ireland by the town council or town commissioners of every borough or town (such town council or commissioners not being manufacturers or sellers of gas), and in Scotland by meetings of justices. The same authorities are to have the appointment of inspectors of meters, who are to be paid out of the county rate, and in boroughs out of any funds applicable for lighting purposes; and if no such fund, then out of the borough fund (in the city of London out of the consolidated rate). Similar arrangements are made in the case of Ireland and Scotland. Inspectors are required to furnish security, are subject to a fine not exceeding £5 for each breach of duty, and are prohibited from repairing, making, and selling meters of gas, and must hold no appointment of any kind in any gas company. Justices of the peace and the town council in boroughs to determine and appoint on what days, at what hours, and at what places the inspectors shall attend with their measuring apparatus within their respective jurisdictions. A trifling fee to be charged for testing, &c., each meter—for meters of a small size it will be 6d.—such fee to be paid over to the treasurer of the county, or to such other person as shall be duly authorised by those by whom he may have been appointed; no meter shall be stamped which shall be found to register, or be capable, by the increase or decrease of water, or by any other contrivance practically prevented in good meters, of registering quantities varying from the true standard measure of gas more than 2 per cent. in favour of the seller, or 3 per cent. in favour of the consumer. The only exception to this which is permitted is where two contracting parties enter into a written agreement to adopt a different kind of meter. At the request and expense of any buyer or seller of gas it shall be lawful for any inspector, authorized in writing under the hand of any justice of the peace in England or Ireland, or of any sheriff, justice, or magistrate in Scotland, at all seasonable times to enter any building, yard, or other place where any meter, whether stamped or unstamped, is fixed, and to examine and test, and if necessary to remove the same. Before this can be done, however, it is necessary that the other party to the contract should have previously received 24 hours' notice in writing of such intention. In case of a disputed decision of inspectors, the point to be referred to two inspectors of adjoining districts. Persons aggrieved may appeal to quarter sessions. After the expiration of 12 months from the passing of this Act no gas meter shall be fixed for use but what has been duly tested and stamped outside in legible letters or figures by an inspector of meters under the provisions of this Act, and every purchaser and seller of gas may at any time after the expiration of the said 12 months require any unstamped meter by which his gas is measured to be examined, tested, and, if found correct, stamped, or he may at his own expense substitute a stamped meter in place of any such unstamped meter.

WESTMINSTER CLOCK.

The following letter has been addressed to the Editor of the *Times*, by Sir Chas. Barry :—

Sir,—My attention has been called to a letter in the last number of the *Journal of the Society of Arts*, from

Mr. Loseby, respecting the Westminster clock, in which he alludes to a statement recently made in the House of Commons by Mr. Fitzroy respecting the minute hands made by my authority, the weight of each of which he reported to be above 3 cwt.

That statement was made, I find, upon the authority of Mr. Denison alone, and, as it has already misled Mr. Loseby, and possibly the public also, I think it right to put you in possession of the facts of the case.

These hands, which are now condemned by Mr. Denison, were prepared under his own control; one of them was submitted to him as a specimen before the remaining three were made, and met with his cordial approval; the others were made by his orders, in strict accordance with the specimen which he had approved; and he fixed the whole of them when finished, and made himself responsible for the cost in so doing. The weight of each hand, exclusive of the external counterpoise, is 1 cwt. and 25lb.

It is obvious, therefore, that Mr. Denison, and he alone, is as fully responsible for those hands as he is for all the other going parts of the clock.

I am, &c.,
CHARLES BARRY.

Old Palace-yard, Aug. 23.

To this letter Mr. Denison makes the following reply:—

Sir,—Our great architect's head has evidently been turned by his unusual run of luck. Hitherto he has been getting that pleasant little *solatium* which architects do, on all his extravagances and miscarriages at Westminster, while other people have got the blame.

Architecture, ventilation, clock-making, dial-making, bell-hanging, it is all the same. The building has cost three times the estimate, and is full of blunders and inconveniences, and for that Gothic architecture and Mr. Scott are to bear the blame and to suffer, and Sir Charles Barry's son, in the Italian line, is to get the benefit, if it can be managed, besides the building of the new Burlington-house without any competition.

The ventilation cost about a quarter of a million, and has to be finished by opening the windows in the vulgar way; and Dr. Reid, whose ventilation of the old House, everybody says was perfect, is sent adrift and pronounced the impostor.

The clock is kept waiting for the tower for five years, and until Sir Charles and his friends were unwise enough to try to throw the blame publicly on me, everybody supposed it was all my fault.

The bell-frame would not stand the striking of the bell, as I had warned his clerk of the works that it would not; but the sagacious Quarm takes care to tell his visitors how tight the bell was screwed up, and to suggest that as the reason why the frame shook; whereas, it was screwed up tight by an architect's engineer, contrary to my intentions, and the frame was no better when it was made loose.

The dials and hands made by him cost £5,900, and the clock only £2,376 up to last April, and somehow or other it is managed to lump them together in a Parliamentary return, with £6,061 more of incidental expenses, neither of of the clockmaker or the bellfounders, and people exclaim, "What a heap of money that clock has cost!"

So now, I suppose, he thinks he can persuade the public that Mr. Fitzroy, who had all the facts before him from both sides, misled the House of Commons the other day, and that I am responsible for the hands made by Sir C. Barry being too heavy to go, and too weak to resist the wind.

I wish Mr. Fitzroy had not contented himself with stating the facts, though he did so quite correctly, and had consented to the papers being printed. The shortest account I can give of the matter is, that Mr. Dent gives credit to the Government for no less than 26 cwt. of old gunmetal, copper, lead, and cast iron, of which Sir C. Barry's minute-hands and their counterpoises were compounded; and that the four new ones, which are a great deal stronger, weigh exactly 8 cwt., the very weight which I myself prescribed to him as the proper one, when I consented to his making them instead of Mr. Dent, in 1856.

To his statements that I approved those hands as ultimately made by him, and that I fixed them, or saw them before they were fixed, or had anything whatever to do with the fixing, I give the flattest contradiction within the compass of the English language. The fixing was as bad as the hands, and such as no clockmaker ever adopts, and such as rendered it impossible to make them balance in all positions.

As he has chosen to stir this question, I will now say that from the time when I was first asked to take this business in hand until now, there has not been a single stage in it in which we have not been put to needless trouble, and the nation to needless expense by Sir Charles Barry's carelessness and blundering. The design of the clock had to be altered to suit his walls, the clock shaft was too wide one way and too narrow the other; the great bell could never have been got up at all if it had been made of the usual shape, though he himself fixed the weight, and therefore the size of it, in 1846; the clock was kept back for years because it has to stand over the only place where the bell could be got up by any contrivance; the clock-room was too dark to work in; the staircase is now in the only dark corner of the tower, and has to be kept lighted with gas, and has windows opening into the ventilating chimney, where charcoal is burnt while Parliament is sitting; and so I might go on with a number more of obstructions, moral and physical, which I have had the trouble of encountering and the satisfaction of defeating.

I am content with the success if Sir Charles Barry is with his percentage; at any rate, he shall have nothing else, he may depend upon it.

Yours obediently,
E. B. DENISON.

August 24.

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

Par. No.

Delivered on 4th August, 1859.
First Session 1859.

222. Benefit Building Societies—Return.

Delivered on 5th August, 1859.

111. Yacht Clubs—Return.
126. Wakefield Election—Minutes of Evidence.
109. Bills—East India Loan.
110. " Reserve Force.
208 (A 2). Poor Rates and Pauperism—Return (A).

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August* 19*th*, 1859.]

Dated 29*th June*, 1859.

1545. W. Wray and J. Wray, Leeming, near Bedale, Yorkshire—Certain imp. in reaping machines.

Dated 19*th July*, 1859.

1656. W. A. Munn, Throwley House, near Feversham, Kent—Imp. in reaping machines.

Dated 20*th July*, 1859.

1708. Z. G. A. N. P. Orioli, 29, Boulevart St. Martin, Paris—New applications of hypochloride of alumina to bleaching and dyeing, and to the disinfection and preservation of organic matters.

Dated 21*st July*, 1859.

1710. H. B. Preston, Liverpool—Imp. in apparatus for superheating steam.

Dated 28*th July*, 1859.

1752. J. Aspinall, Charing cross, Middlesex—Imp. in evaporating and in apparatus for the same, especially applicable to the evaporation of sugar.

Dated 29*th July*, 1859.

1760. S. Wilson, Manchester—Certain imp. in the construction of presses for compressing cotton and other articles.

Dated 30*th July*, 1859.

1766. F. Haeck, Schaerbeek, near Brussels—Imp. in refrigerating apparatus, especially adapted to pumps and other apparatus for the supply of beer and other liquids.
1772. W. Jamieson, Stoney Middleton, Derbyshire—Improved churn. A com.

Dated 1*st August*, 1859.

1774. W. Campbell and G. Worstenholm, Birmingham—Certain imps. in machinery for the manufacturing of wrought nails, as also in the treatment of the iron from which such or other kinds of nails may be made. A com.
1776. T. W. G. Treeby, 1, Westbourne-terrace Villas, Upper-Westbourne-terrace, Paddington—Imps. in targets.
1780. W. E. Newton, 66, Chancery-lane—An improved mode of and apparatus for making metal cylinders suitable for steam boilers and other purposes. A com.

Dated 2*nd August*, 1859.

1786. B. Donkin, Bermondsey, Surrey—Imp. in and in connection with slide and other valves. A com.

Dated 3*rd August*, 1859.

1787. A. Pin, Castelnaudary, France—The compouuding, preparing, and application of a new sort of paint.
1788. J. Hewett, Sheffield—Imp. in self-acting water-closets.
1789. W. K. Peace, Sheffield—An imp. in canisters for hermetically sealing paints and other substances. A com.
1790. M. Mason, Manchester—Imp. in machinery for printing, and in apparatus connected therewith.
1791. W. H. Tooth, 3, Spring-terrace, Wandsworth-road—Imp. in machinery or apparatus for the manufacture of iron or steel.
1793. J. Petrie, jun., Rochdale—Imp. in machinery or apparatus for washing wool.
1794. J. H. Phipson and W. A. Watson, Birmingham—A new or improved lubricator for lubricating shafts and other articles requiring lubrication.
1795. W. H. M. Blews, Birmingham—A new or improved regulator for gas burners.
1796. E. Dowling, Little Queen-street, Holborn—Imp. in rosettes or ornaments applicable to harness, and for other purposes.

Dated 4*th August*, 1859.

1797. T. Lister, Sheepbridge, Derbyshire—An improved sanatory watercloset.
1798. J. Horton, Handsworth, Staffordshire—A new or improved water gauge for steam boilers.
1799. R. A. Brooman, 166, Fleet-street—Imps in mills for grinding coffee, corn, and other substances. A com.
1801. F. Walton, Haughton Dale, Denton, near Manchester—Imp. in the manufacture of ornamantal fabrics, suitable for bookbinding and other uses, and in machines employed in such manufacture.

Dated 5*th August*, 1859.

1803. E. B. Gowland, Brecknock-street, Camden Town—Imp. in pianofortes.
1804. E. Swainson, Preston—Certain imp. in looms for weaving.
1804. N. D. Maillard, 18, York-street, Dublin—Imp. in compasses for indicating the course and time of ships at sea, without the use of needles or magnets.
1907. N. Berry, Paris—An imp. in the manufacture of knitted fabrics. A com.
1809. W. E. Newton, 66, Chancery-lane—An imp. in billiard and bagatelle cues. A com.
1810. F. W. Beaumont, Clapham, Surrey—A hydraulic apparatus applicable to transmitting, regulating, and measuring the supply or flow of liquids.
1811. W. Thompson, 45, Essex-street, Strand—An improved printing telegraph.

Dated 6*th August*, 1859.

1815. A. B. Childs and L. D. Owen, 192, Tottenham-court-road—Imp. in machinery for cleaning grain and seeds from smut and other extraneous matter.
1816. A. T. De Lisle, 14, Addison-road, Kensington—Imp. in clarifying and decolourizing solutions of sugar and other liquids.
1817. E. A. Suwerkrop, Leith—Imps. in reaping and mowing machines. Partly a com.
1818. A. F. Delannoy, Paris—Imp. in lubricating the axles or journals of wheels, also applicable to lubricating apparatus for the transmission of motion in general.
1819. J. W. Welch, Manchester—Imp. in machinery or apparatus for sizing or dressing yarns or threads for weaving.
1820. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for manufacturing chenille. A com.

Dated 8*th August*, 1859.

1821. J. Weston, Fenton, Staffordshire—Imp. in breaks for railway carriages, and in the method of applying the same, and in conveying signals from one part to another of the same train, parts of which are applicable to breaks for other purposes.
1823. H. Liddle, Middleton, Lancashire—Imp. in machinery or apparatus for polishing yarns or threads.
1829. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in apparatus for steering ships, applicable also in all cases where a rotatory or partial rotatory motion is required. A com.
1831. B. S. Cohen, Magdalen-row, Great Prescot-street, Middlesex—Imp. in ever-pointed pencils.
1833. T. Blinkhorn and R. Blinkhorn, New-road, Spalding—An improved composition for removing scale or fur from the interior of boilers, and also for preventing the formation of scale or fur therein.

Dated 9*th August*, 1859.

1835. T. Dunn, Manchester—Imp. in machinery and apparatus for elevating and regulating the level and flow of liquids, part of which is applicable for propelling vessels.
1837. P. F. Roland, Hensies, Belgium—A new electric telegraph.
1839. I. Mitchell and S. Lister, Bradford—An improvement in apparatus applicable to machinery for spinning fibrous materials.
1841. J. B. Babcock, Milk-street, Boston, U.S.—Imp. in bustles and and skirts. A com.
1843. J. D. Bryant, Rock, Cornwall—Improved superphosphate of lime.
1845. B. Browne, 52, King William-street—Imp. in the manufacture of paints and pigments. A com.
1847. W. Mac Lellan, Glasgow—Imp. in parts of the permanent way of railways. A com.

Dated 10*th August*, 1859.

1849. W. Muir, Manchester—Imp. in machinery for communicating motion to foot lathes and other machines to be worked by treadles.
1851. W. K. Westly, Leeds—Improved machinery for combing, heckling, and preparing to be spun flax and other fibrous substances.
1853. A. Shaw—Certain modes or methods of preparing sheep or other skins or pelts, or the linings thereof, and for raising nap on the same, and also for preparing the said skins for kid leather, and for enamelling and japanning the same.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, August* 19*th*, 1859.]

August 19*th*.

506. J. Dale.
513. W. Mc Naught.
523. E. Gatwood.
531. C. Hall and C. Hall
559. J. Newcomb and J. G. Lovell.
631. J. Cunliffe, F. Piggott, and G. Mallinson.
650. C. Desurmont and C. Goudeau.
673. C. Garnett.
758. W. E. Newton.
810. F. Morton.
812. A. V. Newton.
911. D. Doig.
1075. W. McIntyre Cranston.
1201. T. Vicars, sen., T. Vicars, jun., T. Ashmore, and J. Smith.

[*From Gazette, August* 23*rd*, 1859.]

August 22*nd*.

521. J. Hue.
524. F. Brignoles.
536. E. J. Hughes.
537. T. Cloake.
541. J. Edwards.
543. J. Templeman.
545. D. Lichtenstadt.
550. R. H. Collyer.
648. J. S. Dawes.
1026. W. Moxon and J. J. Bennett.
1437. A. V. Newton.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette August* 19*th*, 1859.]

August 15*th*.

1936. H. Burden.

August 17*th*.

1931. C. M. Chouillou.
1950. J. Maudslay.
1955. T. York.

[*From Gazette, August* 23*rd*, 1859]

August 18*th*.

1937. R. Robson.

August 19*th*.

1976. M. A. F. Mennons.

August 20*th*.

1992. A. V. Newton.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4189	July 7	Tool for Filling Cartridges and Closing the ends thereof	John Adams	76, King William-street, E.C.
4190	„ 18	Appendage to Ordnance and Fire Arms	Joseph Chesterton.	Leicester.
4191	„ 29	Glass Water-Gauge, for Steam, Water, or other Boilers where liquid may be used	James Chandler	Creek Foundry, Creek-road, Deptford, Kent.
4192	„ 30	Funnel Valve	John Dockree	30, Robinson's-row, Kingsland.
4193	Aug. 1	Valve for Heating Pipes	Williams and Biven	Reading.
4194	„ 17	Corset Fastener	Cooper and Smith	Ashbourne, Derbyshire.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 2, 1859.

EXAMINATIONS AND GOVERNMENT APPOINTMENTS.

Two nominations to compete for Government Appointments having been recently placed at the disposal of the Council of the Society of Arts by Lord Palmerston, the candidates nominated by the Council were Mr. George William Wicker, of the Watt Institute, Portsea, who distinguished himself at the Society's Examinations last year; and Mr. John Palethorp, of the Mechanics' Institution, Glasgow, one of the prizemen in the Examinations held in May last.

The Council have much pleasure in announcing that both these candidates have been successful, having obtained the third and fifth places respectively.

There were on this occasion five vacancies and fifteen competitors.

EXAMINATION PAPERS, 1859.

(*Continued from page* 648.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last:—

PHYSICAL AND DESCRIPTIVE GEOGRAPHY.

THREE HOURS ALLOWED.

The Candidate is only allowed to answer one Half of the Total Number of Questions in each Section.

I. Physical Geography.

(1.) Give a brief account of either one of the following mountain-systems, making a sketch to show its general direction, and the places of its principal summits:—

(*a.*) The Alps.
(*b.*) ,, Himalaya.
(*c.*) ,, Andes.

(2.) Classify the rivers of either the Asiatic or North American continents, with reference to the seas into which they flow.

(3.) A broad belt of desert stretches through the Old World, in the general direction of east and west. Distinguish its different portions by name, as they follow in geographical succession.

(4.) Extensive tracts of country are known respectively as steppes, prairies, savannahs, pampas, and karroos. Where are these, and what are their distinctive features?

(5.) What are coral islands? Describe their peculiarities of origin and appearance? In what localities are they chiefly found?

(6.) Either write a brief account of the physical geography of one of the following countries, or draw a map in illustration of it:—

(*a.*) Holland.
(*b.*) Switzerland.
(*c.*) Canada.

(7.) Which are (at the present time) the principal gold-producing regions of the globe? How are they most readily accessible from Britain?

(8.) Among food plants, what parts of the globe are the native seats of the following:—Maize, rice, the date-palm, cocoa-nut-palm, banana, cassava, sago, yam, arrow-root, and bread-fruit?

(9.) What peculiarities (in reference to the organic as well as the inorganic kingdom) distinguish the physical geography of Australia?

(10.) Draw up a list of the coal-fields of England and Wales. Mention the principal towns that are within the limits of each.

(11.) Besides latitude, what other circumstances affect climate? Give some examples of their operation, derived from particular localities.

(12.) What are glaciers? Give a brief account of the commonly-received theory (that of Professor Forbes) with regard to them.

II. Descriptive Geography.

(1.) Name the capital city of each of the following countries, with the river on which it stands:—Sardinia, Belgium, Portugal, China, Egypt, New Brunswick, Pennsylvania, Switzerland, Tuscany, Bohemia, the Punjaub, and Burmah.

(2.) Where are the following places:—Chicago, Caracas, Valparaiso, Mobile, Ancona, Taganrog, Saloniki, Beyrout, Jiddah, Kurachee, Rangoon, Herat, and Callao?

(3.) What alternatives of route are offered in the journey from Great Britain to Australia? Name, in geographical succession, the seas, &c., passed through in the case of either.

(4.) What objects of special interest are found within the valley of the Nile, in its course through Egypt? Suppose a person ascending that river, from the Delta to the first cataract, name such objects (of the description referred to) as would successively meet his notice.

(5.) Give some account of either one of the following British Possessions—as to date of acquisition, climate, inhabitants, and industrial resources:

(*a.*) Mauritius.
(*b.*) Hong-Kong.
(*c.*) South Australia.

(6.) Where is British Columbia, and how may it be reached from England? State briefly the substance of what is at present known concerning its natural features and commercial resources.

(7.) Make a sketch, showing, in the case of either one of the under-mentioned rivers, the direction of its stream, its chief tributaries, and the principal towns comprehended within its basin:—

(*a.*) The Thames.
(*b.*) ,, Humber (Ouse and Trent).
(*c.*) ,, Shannon.

(8.) Among celebrated battle-fields, where are the following:— Marengo, Austerlitz, Blenheim, Borodino, Hohen-linden, Talavera, Inkerman, Pultowa, Plassey, Flodden, Towton, and Culloden? Give the situation by reference to some well-known locality, whether town, river, or otherwise.

(9.) Draw up as complete a list as you can of the States comprehended within the Germanic Confederation, naming the capital of each.

(10.) Enumerate the political divisions of South America, giving the capital and chief seaport of each.

(11.) Draw a map of the county in which you reside, marking on it the chief natural features (high or low ground, rivers, &c.), and the places of the principal towns.

(12.) What is meant by the north-west passage? What object was proposed it its accomplishment?

ENGLISH HISTORY.

THREE HOURS ALLOWED.

You are to answer the whole, or as many as you can, of the eight following questions:—

(1.) Explain the following terms:—

Thane.
Frankpledge.
Homage.
Tallage.
Lord Paramount.
Villein Regardant.

(2.) Between whom, and in what reign, was each of the following battles fought:—

Assaye.
Bannockburn.
Brunanburgh.
Bunker's Hill.
Camperdown.
Lewes.
Minden.
Salamanca.
Zutphen.

(3.) What English kings, or sons of English kings, took part in the Crusades? Mention briefly the chief events of each Crusade, in which an English king or an English prince was engaged.

(4.) Give a brief account of the chief voyages and discoveries of—

Cabot.
Cooke.
Drake.
Hawkins.
Raleigh.
Willoughby.

State in what reign each voyage was made.

(5.) What instances of parliamentary impeachment were there before the end of the reign of Richard II? Point out the differences between an impeachment and a bill of attainder.

(6.) What English sovereigns, since the Conquest, died by violent deaths. State where and how each of them died.

(7.) When were the English Boroughs first represented in Parliament? When were the Burgesses formed into one house with the Knights of the Shires? By whom were the Knights of the Shires originally elected? What changes as to the right of voting for Knights of the Shires were made in the reign of Henry VI.

(8.) What were the principal constitutional checks on the Royal Power at the time of the accession of the first sovereign of the House of Tudor.

You are to answer four, or as nearly four as you can, of the following six questions.

You are to select those which you think yourself best able to answer fully.

No marks will be obtained by answering more than four.

(1.) In what respects did Feudalism, as established by the Normans in England, differ from Feudalism as generally established in Continental Europe?

(2.) Give a brief account of the disputes between Thomas à Becket and Henry II. Give also a brief account of the Statutes of Provisors, and of the Statutes of Mortmain. Mention in what reign, and under what circumstances, each statute, which you refer to, was passed.

(3.) What was provided in the Great Charter of John as to the summoning of the Great Council, and as to the pecuniary grants to the King? What variances are there as regards these matters between the preliminary "Articuli Chartæ" and the Charter itself? What variances, also are there in these respects between the Great Charter of John, and the Great Charter as regranted in the reign of Henry III.? What has been provided as regards the right of taxation by the statutes entitled Confirmatio Cartarum and the Petition of Right?

(4.) Give an account of the Statutes of Labourers and of the Statutes as to Vagrants, that were passed in the reign of Edward III. and Richard II., and add a brief sketch of English Legislation as to the poor, between the time of the Reformation and the end of the reign of Elizabeth.

(5.) Give a brief account of the following treaties, and mention the sovereigns and statesmen by whom each was effected:—

The Treaty of Bretigny.
The Treaty of Troyes.
The Treaty of Cateau Cambresis.
The Treaty of the Triple Alliance.
The Treaty of Ryswick.
The Spanish Partition Treaties.
The Peace of Amiens.

Point out how any of these treaties illustrate the doctrines of international law respecting the balance of power.

(6.) Give a brief account of the state of the English power in Ireland at each of the following epochs:—

At the end of the reign of Henry II.
At the end of the reign of Edward II.
At the end of the reign of Henry VII.
At the end of the reign of Elizabeth.
At the end of the Protectorate of Cromwell.

What were the chief causes that facilitated the first successes of the English in Ireland, and what chiefly retarded the complete conquest of that island? Give an account of Poyning's law in Henry VII.'s reign. When were its provisions altered or repealed?

ENGLISH LITERATURE.

THREE HOURS ALLOWED FOR THE TWO AUTHORS SELECTED BY THE CANDIDATE.

Chaucer.

(Prologue to the Canterbury Tales.)

Section I.

(1.) Turn into modern English the following passage:—

"With us ther was a Doctour of Phisike,
In all this world ne was ther none him like
To speake of phisike, and of surgerie:
For he was grounded in astronomie.
He kept his patient a ful gret del
In hours by his magike naturel.
Wel coude he fortunen the ascendent
Of his images for his patient.
He knew the cause of every maladie,
Were it of cold, or hote, or moist, or drie,
And wher engendred, and of what humour,
He was a veray parfite practisour.
The cause yknowe, and of his harm the rote,
Anon he gave to the sike man his bote.
Ful redy hadde he his apothecaries
To send him dragges, and his lettuaries,
For eche of hem made other for to winne:
Hir friendship n'as not newe to beginne."

(2.) Mark the feet in the above passage.—What are the chief peculiarities in the pronunciation of the English of Chaucer's time, which it is necessary to observe in order to bring his verse within the laws of metre?

(3.) Explain the obsolete words and constructions.

(4.) What light does this passage, with its context, throw on the state of medical practice in the age in which it was written?

Section II.

(1.) Explain one of the following passages:—

"And he hadde be sometime in chevachie,
In Flandres, in Artois, and in Picardie,
And borne him well, as of so litel space,
In hope to stonden in his ladies grace."

"Ful freshe and newe hir gere ypiked was.
Hir knives were ychaped not with brass,
But all with silver wrought ful clene and wel,
Hir girdeles and hir pouches every del."

(2.) Explain the following words and phrases:—sote, swiche, lazar, tretis, fetise, herberwe crulle, vernicle, pilwebere—by culpons on and on—all pomelee grey and highte Scot—surcote of perse.

(3.) Give a brief notice of three of the ecclesiastical persons mentioned in the Prologue.

(4.) Give a sketch of Chaucer's life, with a list of his works.

SHAKSPERE.

Macbeth; Richard II.; The Tempest.

SECTION I.

(1.) Explain the following passages, notice any peculiarities in the words or grammatical constructions, give any various readings with which you are acquainted, and state the connexion in which each passage occurs:—

(a.) "In the devotion of a subject's love,
Tendering the precious safety of my prince,
And free from other misbegotten hate.
Come I appellant to this princely presence."

(b.) "But you, O you,
So perfect and so peerless, are created
Of every creature's best."

(c.) "What man dare, I dare;
Approach thou like the rugged Russian bear,
The armed rhinoceros, or the Hyrcan tiger,
Take any shape but that, and my firm nerves
Shall never tremble: or be alive again,
And dare me to the desert with thy sword;
If trembling I inhabit then, protest me
The baby of a girl."

(d.) "Desolate, desolate, will I hence, and die;
The last leave of thee takes my weeping eye."

(e.) "This was well done, my bird;
Thy shape invisible retain thou still:
The trumpery in my house, go, bring it hither,
For stale to catch these thieves."

(f.) "Let your highness
Command upon me; to the which, my duties
Are with a most indissoluble tie
For ever knit."

(2.) Give the sense of one of the following passages in simple prose, and state in what connexion it occurs.

(a) "The night has been unruly: where we lay,
Our chimneys were blown down: and as they say,
Lamentings heard i' the air; strange screams of death:
And, prophesying with accents terrible
Of dire combustion and confused events,
New hatched to the woful time,
The obscure bird clamoured the live-long night:
Some say the earth was feverous and did shake."

(b) "——learn good soul
To think our former state a happy dream;
From which awaked, the truth of what we are
Shows us but this: I am sworn brother, sweet,
To grim necessity; and he and I
Will keep a league till death."

(c) "Thee, of thy son, Alonso,
They have bereft; and do pronounce, by me,
Ling'ring perdition (worse than any death
Can be at once) shall step by step attend
You, and your ways; whose wraths to guard you from
(Which here, in this most desolate isle, else falls
Upon your heads) is nothing, but heart's sorrow
And a clear life ensuing."

SECTION II.

(1.) Give some account of the sources from which Shakspere took the plots of Macbeth and Richard II.

(2.) What are the chief particulars in which Shakspere has deviated from historical authority in Richard II?

(3.) Compare the character of Macbeth with that of Lady Macbeth, and illustrate your comparison by references and quotations.

(4.) Sketch the character of Bolingbroke as represented by Shakspere, and compare it with that of Richard.

(5.) At what dates were Richard II., Macbeth, and the Tempest probably written?

(6.) What do you know of the state of the text of Shakspere's plays? Give any remarkable examples of various readings.

BACON.

(Essays.)

SECTION I.

(1.) How does Bacon prove and illustrate the following propositions:—

"It is true that a little philosophy inclineth man's mind to atheism; but depth in philosophy bringeth men's minds about to religion."

"Men's thoughts are much according to their inclination; their discourse and speeches according to their learning and infused opinions; but their deeds are after as they have been accustomed."

(2.) Explain the following passages:—

"Divide, with reason, between self-love and society."

"The part of Epimetheus might well become Prometheus in the case of discontentments."

"A man cannot tell whether Apelles or Albert Durer were the more trifler."

(3.) Give the substance in brief of the essay "Of Friendship," or of that "Of the true greatness of Kingdoms and Estates."

(4.) Distinguish between simulation and dissimulation. Under what conditions does Bacon justify them? How far is his line of argument consistent with true morality?

(5.) Explain Bacon's use of the following words:—

Munite, tracts, galliard, poller, herselike, beholding, misanthropi, stirp, motion, consort, advoutress, appose, bravery, gaudery.

(6.) State the date of the first publication of Lord Bacon's essays, and give some account of the earliest editions of the work.

ADDISON.

(Contributions to the Spectator.)

SECTION I.

(1.) Explain the meaning of the following passages, and state the connexion in which each of them occurs:—

"I am a Dane, Swede, or Frenchman at different times; or rather fancy myself like the old philosopher, who, upon being asked what countryman he was, replied, that he was a citizen of the world."

"Sir Paul Rycant gives us an account of several well-disposed Mahometans that purchase the freedom of any little bird they see confined in a cage, and think they merit as much by it as we should do here by ransoming any of our countrymen from their captivity at Algiers."

"I am sorry to find that an author, who is very justly esteemed among the best judges, has admitted some strokes of this nature into a very fine poem, I mean "The Art of Criticism," which was published some months since, and is a masterpiece in its kind."

(2.) Give a short account of the first Vision of Mirzah.

(3.) Analyse briefly the essay on the Pleasures of the Imagination, or the essay on Cheerfulness.

(4.) What were the names and characters of the chief members of the Spectator's Club?

(5.) In what respect are the following expressions antiquated? Can you give other instances of the same kind from Addison's writings?

"Our conferences go no further than a bow or a grimace."

"Nothing is so modish as an agreeable negligence."

"Cheerfulness in an ill man deserves another name."

Section II.

(1.) Write a short narrative of the origin, progress, and termination of the publication of the Spectator.

(2.) Give some account of Addison's coadjutors in the work.

(3.) What are the characteristic merits of Addison's papers, as compared with those of his assistants?

(4.) Name the best known works of Addison, prose and poetical, distinguishing the most important of them.

Goldsmith.

(Poetical Works.)

Section I.

(1.) Explain the following passages, and state the connexions in which they occur:—

"Here lies our good Edmund, whose genius was such,
We scarcely can praise it, or blame it too much."

"Ill fares the land, to hastening ills a prey,
Where wealth accumulates, and men decay."

"How did Grub-street re-echo the shouts that you raised.
While he was be-Rosciused and you were bepraised."

"With food as well the peasant is supplied,
On Idra's cliffs as Arno's shelvy side."

"The Terence of England, the mender of hearts."

"The lifted axe, the agonizing wheel,
Luke's iron crown, and Damiens' bed of steel,
To men remote from power but rarely known,
Leave reason, faith, and conscience, all our own."

(2.) Express the sense of the following passage in simple prose and give its context:—

"O blest retirement, friend to life's decline,
Retreats from care, that never must be mine,
How blest is he who crowns, in shades like these,
A youth of labour with an age of ease;
Who quits a world where strong temptations try,
And, since 'tis hard to combat, learns to fly!
For him no wretches, born to work and weep,
Explore the mine, or tempt the dangerous deep;
Nor surly porter stands in guilty state,
To spurn imploring famine from the gate."

(3.) Explain the allusions in the following passage, and state the connexion in which it occurs:—

——" not far removed the date
When commerce proudly flourished through the state;
At her command the palace learned to rise;
Again the long-fallen column sought the skies;
The canvas glowed, beyond e'en nature warm;
The pregnant quarry teemed with human form:
Till, more unsteady than the southern gale,
Commerce on other shores displayed her sail;
While nought remained of all that riches gave,
But towns unmanned, and lords without a slave;
And late the nation found, with fruitless skill,
Its former strength was but plethoric ill."

Section II.

(1.) What work appears to have suggested to Goldsmith the idea of the Traveller? If you can, give some account of it, and compare it with the Traveller.

(2.) What personal allusions are there in the Traveller? To whom is it dedicated?

(3.) Give the substance of the dedication to the Deserted Village. What personal allusion is the poem supposed to contain? State its main argument, and express your opinion as to its correctness. Compare this argument with the passage on Britain in the Traveller.

(4.) Sketch very briefly the life of Goldsmith. Who were his best known personal friends? Give a list of his principal prose works and his plays, distinguishing those which have most merit.

(To be continued.)

UNIFORM MUSICAL PITCH.

The following is extracted from the *Athenæum*:—

A timely piece of reading is to be found in a book by M. Adrien de La Fage (Dentu), on "Tonic Unity and the Establishment of a Universal Diapason,"—being the substance of some letters which appeared in the *Gazette Musicale* in 1856; here republished, with additions and appendical notes. Timely, however, is not synonymous with well-tempered. M. de La Fage takes that side of the question towards which we lean,—namely, that the attempt at uniformity is less called for than has been stated;—further, that, if fixity be ever so stoutly agreed on, by a Government adopting a report, collected on evidence, attracted by theory—to enforce such fixity is simply impossible. Such are the views which have been suggested again and again in the *Athenæum*,—but they are made somewhat suspicious, on being put forth by M. de La Fage, by the sore and aggressive tone of his glosses and intimations.

Let us, however, group together one or two remarks of interest with one or two comments. These may help to show that dissentients may dissent from conviction, not fractious perversity. It may be remembered that, on reading that report of the French Commissioners, which led to the measures adopted by French autocracy, we questioned, not the sincerity of the collectors, but the validity of the evidence. It appears that others, more scientifically competent to speak, have shared our question on the subject. Stress, it may be recollected, was laid in the report on the comfortable pitch of the Carlsruhe A,—a quarter of a tone below that of the Opera at Paris. On this, M. de La Fage remarks,—being corroborated in his caution by M. Aristide Cavaillé-Coll, the great French organ-builder (no bad authority):—

> "It is very possible that the tuning-fork sent, from Carlsruhe, to the Commission, may not have been precisely that of the orchestras of the town. In fact, at the last festival at Baden, directed by M. Berlioz, the Carlsruhe musicians, without the slightest difficulty, tuned their instruments with those from other towns, where the diapason was as high as, or higher than that of Paris; so that there could not have been a quarter of a tone difference. It is not then, impossible but that the fork sent was simply the *kapellmeister's* own."

Something of the kind had already struck us as probable, from remembering the caprices and accommodations elsewhere, which have no authority in deciding the question. In 1839-40, the visitor who went to Dresden to hear the church music of the Saxon capital was warned beforehand that in the Catholic Church, of which, if we mistake not, Morlacchi was then chapel-master—and where were a Silbermann organ with some choice Italian stringed instruments—he would hear a diapason nearly half a tone flatter than it was anywhere else—and why?—to accommodate the voices of certain Italian artificial *soprani*—relics of an elder world—who at that time belonged to the choir of the Catholic Church.—One or two other extracts from the comments of M. Cavaillé-Coll, as discussed by M. de La Fage, are worth quoting:—

> "He," says our author, "disapproves of the use proposed by M. Berlioz of an organ pipe, as regulating the orchestral pitch of theatres; since nothing is more variable than the tone of an organ-pipe, owing to the change of temperature."

No want of knowledge on the part of M. Berlioz concerning organs will surprise those who are familiar with his writings on instrumentation; but the fact must be pointed out, as indicating the slack and random way in which a subject of such great delicacy as this can be treated by its jurors. A remark or two more are worth having:—

> "We conceive," writes M. Cavaillé-Coll, in 'L'Ami de la Religion,' that the real cause of rise of pitch—of which no one will accept the responsibility—is artistic progress, and not the ignorance or caprice of such or such other maker, composer, or instrumentalist. The progress which is accomplished equally in all civilised countries, and the march of which nothing can stop, is here manifested as in science and mechanical art. We habituate ourselves insensibly to the ameliorations which it produces;

but, if we look back, we see then the distance which we have passed over."

This is the one practical view of the question. Sumptuary laws (to illustrate by a parallel) do not belong to our time. *Delia* will spend on her back what *Jemima* puts on her table. One conductor will have his brilliant fancy; another, who has been used to "potter an immensity" (as Mrs. Fanny Kemble phrased it) over a flat old organ, will indulge his sleepy notions. One railway company will carry its express at the rate of forty miles an hour; another (as in Belgium) will complacently manage fifteen, and perhaps complain of going too fast. As practicably could a normal yellow, red, or blue be imposed on an Academy of Painters to check a Turner *redivivus* in the sun-glare he flings about his "Rock Limpet," or an Allston, when he is trying at a "Uriel" in the sun. Then, too, as a correspondent suggested to the Society of Arts, the taste of the time for brilliancy has been fed and fostered by modern composers, at the instance of those very singers, who, when they become effete, or have not learnt to sing, are the first to complain of it. It was said to us, the other day, by a master as shrewd as distinguished,—"If you write a song now-a-days, the first change which the singer wishes is his favourite high note put somewhere." Every *mezzo-soprano* now-a-days *will* finish her air on the tone an octave above its original close with a penultimate shake. Signor Tamberlik *stings* his gratuitous c sharp into the "Otello" duett, to add effect to Signor Rossini's final phrase;—Madame Miolan Carvalho ends her Shadow Waltz in "Le Pardon" on D flat in *alt*, in place of D on the line. All who *can*, *will* get up. The waters are out; there is no calling them back. Here, again, is a morsel of evidence, by M. de La Fage, worth weighing:—

> "I do not approve," says he, commenting on the passage just paraphrased, "all the developments which M. Cavaillé-Coll has given to his idea; but, like himself, I consider that during the past half-century orchestras have doubled in intensity; that consequently, with the *letting-down* principle, which would take us fifty years back, it would be necessary for the Commission simultaneously to propose the exclusion of those brass instruments which were not employed at that epoch, and which, were the old pitch adopted, could not be properly played now-a-days."

Last of all, comes yet one difficulty more—a difficulty, obviously, of great weight, and not small delicacy:—

> "The verification of tuning forks" [*vide Athen.* No. 1653, p. 25] "brings out many questions. Two or three of these are obvious. * * What would happen if a skilled verifier,—such, for instance, as was M. Cagniard Latour,—were to examine a fork, officially accredited by M. Lissajous, and were the vibrations not to be exactly accredited? What if M. Lissajous himself, verifying, at some interval of time, the same fork, found different vibrations at different intervals? Better than myself, he knows that such things may happen."

So, too, does Mr. Hullah; whose evidence given—given, too, anxiously, on the side of uniformity, at the meeting of the Society of Arts—was the testimony of a man more anxious for truth than for the St. Martin's Hall *La*. His two identical forks, when exposed to different temperatures, he assured the meeting, became different in vibration. What was more, when fork A and fork B were cooled to the same coldness, the *ex*-hot fork did not recover its old and cold composure.—The immutability of metallic vibration may be a new question; but we have not found that it has been sufficiently established by the scientific gentlemen who have in this case undertaken a subject the importance of which is far greater to Art than to Science.

DEODORIZATION OF SEWAGE.

The following report has been addressed by Dr. Hofmann, F.R.S., and Dr. Frankland, F.R.S., to the Metropolitan Board of Works:—

Having been requested by a resolution of your Board, bearing date the 27th day of May, 1859, to undertake the duty of advising the Board as to the selection, from the various schemes proposed for the deodorization of sewage, of a process combining both efficiency and economy, we now beg leave to report to you the result of a minute inquiry into this subject.

In conducting our investigation, we have carefully kept in view the final plan of dealing with the sewage adopted by the Board, the principal features of which were lucidly described to us in a letter from your chief engineer.

Not the least arduous part of our labours consisted in the careful examination of the numerous, and in many cases ponderous, documents addressed to the Board on this subject, and transmitted to us for consideration. Short abstracts of these proposals will be found in the Appendix.

This examination led us to the conclusion that a comparatively very small number only of these proposals admit of application in conformity with the plan of dealing with the sewage finally adopted by the Board.

The comparatively small number admitting of such application, experienced a further limitation when the several processes were submitted to experimental trial. In fact, of all the proposals, old and new, referred to us, there is only one which appears to satisfy in the necessary degree the conditions involved in the circumstances of the case.

The agent to which we allude is that described as "Dales' Muriate of Iron," essentially a concentrated solution of perchloride of iron, the disinfectant properties of which were some years ago pointed out by Mr. Ellerman. This we have submitted to an extensive series of comparative trials with the well-known disinfectants, lime and chloride of lime, which, probably owing to their long-established character, are not included in the proposals before us.

These trials lead to the conclusion that the deodorization of sewage may be effected either by the perchloride of iron, chloride of lime, or lime; but that, if quantities of equal value* be applied, the perchloride of iron is markedly superior to either of the others, whilst chloride of lime acts much more powerfully than lime.

These statements refer both to the immediate action of the three agents upon sewage, and to the permanency of the effect produced; but when examined from the latter point of view, the superiority of the perchloride of iron is exhibited even in a still more marked degree.

It may be stated that these results were obtained by operating upon sewage, such as flows from the mouths of the chief metropolitan sewers during the hottest season of the year, our experiments having been performed during the latter half of the month of July.

Since the calculations as to the cost of deodorization are based upon these experiments, it may not be out of place here to mention briefly the mode in which they were conducted. In order to enable us to operate upon a sufficiently large scale, brickwork tanks, lined with cement, and holding 7,500 gallons each, were constructed at the outfall of the King's Scholars' Pond Sewer. The sewage was lifted into these tanks by means of a steam pump, and the various deodorizing agents were incorporated, either by their gradual introduction into the shoots during the process of filling, or by diffusing them through the mass of the liquid by means of mechanical agitation.

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* We have endeavoured to arrive at the average prices of these three agents. It appears that they are subject to considerable fluctuation. As the average result of our inquiries, we have taken the value of lime at 9s. per cubic yard = 18 bushels; the value of chloride of lime of 36 per cent. (about the strength of that used in our experiments), at £12 per ton; and that of the perchloride of iron solution, specific gravity 1·45, at 6d. per gallon. Probably these prices would be subject to a certain amount of reduction if very large quantities were consumed. We should state further, that the estimation of the value of perchloride of iron is founded upon our knowledge of the price of its ingredients and the cost of manufacture, although Messrs. Ellerman and Dales, who have proposed this liquid, quote 1s. 6d. as their maximum price per gallon.

From a number of experiments thus conducted, it appears that each of the three agents above mentioned will effect the immediate deodorization of 7,500 gallons of sewage when applied in the following proportions:—

Perchloride of iron........................	½ gallon.
Chloride of lime..........................	3 lbs.
Lime..	1 bushel.

From these results it follows that 1,000,000 gallons of sewage require respectively—

	£	s.	d.
66 gallons of perchloride of iron, costing	1	13	3
400 lbs. of chloride of lime	2	2	10½
132½ bushels of lime...........................	3	6	6

During the performance of these experiments, which, as already stated, were made during the hottest portion of a dry season, we were surprised to find that the liquid flowing from the outfall of the sewer was by no means strongly offensive; it was only after preservation in tanks for twenty-four hours, or upwards, that a really powerful odour manifested itself. This circumstance rendered it of the highest importance to inquire more closely into the degree of permanency of the effect produced by the several agents under consideration.

For this purpose, three equal quantities of sewage were collected, and perfectly deodorized respectively by perchloride of iron, chloride of lime, and lime: they were then allowed to stand. After two days, the sewage disinfected by lime became slightly tainted, whilst that deodorized by chloride of lime and perchloride of iron remained perfectly odourless. At the end of three days, the limed sewage had become decidedly offensive, whilst the other two specimens still remained free from smell. After four days, the odour of the limed sewage had become worse, but that treated with chloride of lime likewise began to exhibit an offensive character, whilst the sewage to which perchloride of iron had been added remained perfectly inodorous. Even after the lapse of nine days, the condition of the latter had not changed. In other experiments the same relative permanency of effect has been observed.

Another important element in estimating the comparative fitness of an agent for the treatment of sewage, is, the time required for clarification after the addition of the disinfectant. In this respect, also, the results of the preceding experiments lead us to give a decided preference to perchloride of iron.

It now remains to apply the results thus obtained to the circumstances of the case before us. From the statements in Mr. Bazalgette's letter, it appears that it is at present contemplated to collect the larger proportion of sewage in two reservoirs, to be constructed respectively at Barking Creek and Crossness Point, in which it would be allowed to settle for about nine hours and a half, in order to be discharged into the river during the first two hours and a half of the ebb tide. The third portion of sewage, we learn from Mr. Bazalgette's letter, will be pumped into the river all the year round at a point near Cremorne Gardens, termed the outfall for the Western Division. The subjoined table gives the quantities of sewage discharged at present daily, according to Mr. Bazalgette's estimate, and likewise the quantities anticipated in future years.

	Present.	Prospective.
Discharge of Sewage at Barking Creek	56,536,875	62,500,000
Do. Crossness Point	20,066,250	35,937,500
Do. The outfall of Western Division	4,646,875	9,375,000
Total	81,250,000	107,812,500

The sewage discharged at Barking Creek and Crossness Point would probably not require deodorization, except during the hot season of the year—say during three months. Supposing the deodorization to be effected by perchloride of iron, the disinfection of this portion of the sewage at the present rate of flow would involve an expenditure of £11,620 13s. 9d. for the three months. We are, however, of opinion that in practice the sewage discharged into the river at this distance from the metropolis would rarely require deodorization for so long a period as three months. In fact, we are not without hope that the sewage, supposing it to arrive at these outfalls in a condition similar to that in which it is at present discharged from the King's Scholars' Pond Sewer, would, when properly freed from suspended matter, only require deodorization under particularly unfavourable circumstances.

With regard to the sewage discharged at the outfall of the Western Division, it will be indispensable to submit it to a systematic deodorization the whole year round. Owing to the comparatively small fraction of the sewage delivered at this point, a very moderate sum would cover the expense—£2,821 3s. 0d. being the cost of the disinfectant for the year.

Having thus stated the results of our experiments regarding the process of deodorization, it remains only to draw particular attention to the importance of discharging the sewage into the river as free from mechanically-suspended matter as possible. We have found that this suspended matter, when separated even from the deodorized sewage, rapidly passes in warm weather into a state of active putrefaction. The removal of this matter would, in a great measure, prevent the formation of any offensive deposit upon the banks of the Thames, not to speak of the improvement in the appearance of the river which would thus be secured. We are therefore of opinion that filtration should be invariably employed at the outfall of the Western Division, and that subsidence, if not actual filtration, should be resorted to at the two remaining outfalls.

The putrefactive tendency of the deposit separated by filtration or subsidence, renders its rapid removal from the reservoirs or filters a matter of the utmost importance, especially during summer; for the process of putrefaction, when once commenced, can be arrested only by quantities of disinfectants practically impossible.

It is not within our province to enter into details respecting the mechanical arrangements necessary for the application of the disinfectant, or for the filtration and subsidence of the sewage; but we beg to express our opinion, based upon the experience acquired during this investigation, in manipulating with comparatively large quantities, that the disinfection of vast volumes of sewage can be more easily accomplished than is generally believed, and than we ourselves anticipated at the commencement of our inquiry. The actual process of deodorization will probably present less difficulty than the mechanical separation of the deposit by filtration or subsidence. This separation will involve the temporary storage of immense quantities of sewage, the rapid removal of large quantities of deposit, and a number of operations which can be successfully carried out only with considerable system and under strict inspection. Operations of this kind should be as far as possible conducted at a distance from densely populated districts; and we consider it therefore a happy feature of the scheme adopted by the Board, that a small fraction only of the total amount of sewage requires to be manipulated in the immediate neighbourhood of London.

(Signed) A. W. HOFMANN,
E. FRANKLAND.

London, August, 1859.

APPENDIX.

In the body of the report we have alluded to the considerable number of proposals addressed to the Metropolitan Board of Works, and referred by them to us for examination. In order to divest the report as much as possible of embarrassing detail, we have refrained from entering into a description of each of the several suggestions which have been made. We have, however, thought it desirable to give condensed abstracts of these proposals, in this Appendix.

John T. Barry, Esq., proposes proto-sulphate of iron as a disinfectant for sewage, and also suggests that charcoal might be introduced into the air-spaces of sewers, in order to destroy noxious gases.

G. Lindsey Blyth, Esq., recommends that superphosphate of magnesia should be mixed with the sewage, which should then be precipitated with lime, or another alkaline earth, the object being the production of a manure.

W. Burness, Esq., recommends separate systems of drainage for sewage, and for surface water. The latter he would filter, if necessary, before its discharge into the Thames; the sewage he would pump to the proper level, and pass through suitable pipes for distribution in the surrounding agricultural districts, completing the distribution before the sewage had time to putrify and become offensive. He is of opinion that the value of liquid manure is much greater than that indicated by its constituents, because "during the process of decomposition of animal and vegetable matter, oxygen is worked up both from water and the atmosphere; consequently hydrogen is liberated from the former, and nitrogen from the latter; so that these two uniting, form ammonia, one of the best fertilisers."

Gurney Burt, Esq., states that he will shortly make a proposal for utilizing the London sewage, without deodorization, by distributing it over the country, by means of the railways.

Henry Callen, Esq., recommends the deodorization of sewage by galvanic or electric agency.

John Chisholm, Esq., makes a similar proposal.

Henry Bollman Condy, Esq., calls attention to the manganates and permanganates as powerful agents of deodorization and disinfection.

Henry Cornfoot, Esq., suggests ferruginous sulphate of alumina, commonly called Moll's Patent Reactive, as a deodorizer for sewage.

Daniell Dealey, Esq., chemist, and William Richards, Esq., engineer, propose to generate chlorine from "a mixture of muriatic acid and quick lime," on board a steamer, which is to be "constantly running up and down the river, and discharging the gas on both sides as it goes along."

Richard Dover, Esq., advises to flush the sewers daily "with the antiseptic hydrochloric acid, and liquefied proto-sulphate of iron, and chloride of sodium combined."

C. F. Ellerman, Esq., recalls attention to the use of perchloride of iron, which he proposed some years ago as a disinfectant.

Richard Ely, Esq., intimates that he has a process for the precipitation of sewage in reservoirs, of which no further description was obtained.

Charles F. A. Glassford, Esq., proposes to carry off the rain water in the sewers, and to make such arrangements in the houses as to allow only a limited quantity of water to become mixed with the excreta. This mixture is to be collected in vessels to be daily discharged into reservoirs, where it is to be mixed with sulphuric acid, and allowed to settle. The liquor is to be then evaporated, and the solid matter squeezed through such filter-presses as are used at the Leicester Manure Works.

G. Garbert, Esq., of Mauritius, suggests the abolition of water-closets, and the substitution of boxes containing peat charcoal.

M. Gronvelle proposes to deodorize by means of a pyrito-aluminous lignite, commonly called "cendre noir," which is stated to be extensively used by the scavengers in Paris.

William Goreham, Esq., communicates the following plan:—To form reservoirs at the mouths of the sewers; to allow the sewage to settle in these reservoirs; to remove the sediment by trays, and to disinfect and dry the contents of the latter by placing them in chambers through which the products of combustion of a suitable furnace are passing.

John Hitchman, Esq., gives his arguments in favour of

"The rainfall to the river,
The sewage to the land."

Mr. Howard, British Minister in Lisbon, reports on a contract between the municipality of that town and a company formed for collecting the excreta and converting them into sewage. The company propose to supply each house with a separating apparatus, and with the necessary disinfectant (the nature of which is not stated). The Municipality will compel the inhabitants to use the apparatus, and proposes to furnish the land for the works.

Henry Kemp, Esq., suggests "pyritous peat" for deodorizing sewage. In a second communication Mr. Kemp enters into some details regarding the mode of applying the peat, which he proposes to enclose in wire cages attached to the sterns of the river steamers; and he advises the introduction of similar cages into the mouths of the sewers.

Charles F. Kirkman, Esq., offers to exhibit upon a large scale the practicability of a plan which he has successfully employed upon a small scale. He does not state the nature of the plan in his original communication, but in a subsequent letter mentions that his method is not a chemical one.

James Knight, Esq., proposes to establish a number of filter-beds on each side of the mouth of a sewer, and to allow only the clear water from which the solid matter has been deposited, to flow into the Thames.

C. N. Kottula, Esq., proposes to remove the Thames' nuisance by increasing the specific gravity of the river over that of sea-water, "so that the river-water may become heavier than that of the sea; whereby the former, instead of being driven back by the incoming tide, will give way to the flow of the sea-water, and will allow it to flow up, while the river-water will run out, or, at all events, remain under the sea-water." He thinks he can accomplish this object "by dosing into the river at various points common salt."

M. G. M. Legé suggests to attach to the drain of each house a receptacle so constructed as to allow of the separation of the liquids from the solids; the former to be permitted to pass into the sewers, and the latter being removed once in eight or ten days, to be converted into manure.

M. Louis Napoleon Legras states, that he has invented a deodorizer which is applicable to London sewage water, and which produces a valuable manure. The nature of the agent is not stated, and no information could be obtained on application.

A. McDougall, Esq., and Dr. Angus Smith, propose the use of carbolate of lime in solution, and also of a solid mixture of sulphites and carbolates. These substances are to be added to the sewage to produce immediate and permanent deodorization.

F. C. Maguire, Esq., advises to convey the sewage to railway stations, and then to transmit it to the surrounding agricultural districts through earthenware or iron pipes. If necessary and practicable, he would filter it through dry sewers constructed over the present drains, converting the solid matter into manure, and deodorizing the filtered liquid in subterraneous deodorizing docks; the deodorized fluid to be then pumped into reservoirs at levels, sufficient to allow of its being conveyed in pipes along the various lines of railway to the provinces. He proposes no method of deodorization.

M. J. Marino, of Copenhagen, communicates a plan for inodorous water-closets.

Dr. Henry Medlock, suggests that sewage would probably be deodorized by means of scrap iron, and subsequent filtration through beds of sand and charcoal; but he states that he has not yet had an opportunity of testing the efficacy of this suggestion on a sufficient scale and by a sufficient number of experiments.

M. Moll, *vide* Henry Cornfoot, Esq.

George F. Morrell, Esq., calls attention to the deodorizing properties of chloride of zinc.

The Rev. Henry Moule proposes to separate the sewage from the rainfall; the liquid portion of the former to be evaporated, the solid to be dried and deodorized. The ordinary modes of evaporating are stated to be chimerical, but the plan proposed is rendered perfectly possible "by the discovery in November last of something in the nature of steam which was hitherto unknown."

W. Oldham, Esq., suggests to separate the solid filth from the sewage, and to distribute the liquid over the land in the neighbourhood.

M. Paulet, Fils, recommends the use of a mixture of sulphate oleate and chloride of zinc, and of sulphate of manganese, for the deodorization of sewage.

William Richards, Esq., *vide* Daniell Dealey, Esq.

Dr. T. Angus Smith, *vide* A. McDougall, Esq.

Rudolph Turecki, Esq., states that he has discovered a material which enables him to disinfect excrementitious matters, and to convert them into manure; but he does not state the nature of the materials which he employs.

Mr. Wells is in possession of a method for the treatment of sewage, but states that it is not chemical, and is communicable only by personal interview.

Sir William Worsley suggests the conveyance of the sewage to a cesspool in the Greenwich Marshes, thence to flow into the river at the turn of tide. No method of deodorization is suggested.

A glance at these proposals will show at once how few of them address themselves to the special question submitted to us for inquiry. A final plan of disposing of the sewage having been fixed upon by the Board, our investigation was of necessity limited to a comparison of the efficiency of the several deodorizing agents proposed.

After experiments continued for several weeks, we arrived at the conclusions already stated in our report.

In these experiments we had occasion to observe, that most of the agents proposed possess the disinfecting power which their inventors have pointed out, and many of them in so marked a manner as to render them undoubtedly valuable for a variety of special purposes. Not one of them, however, in our opinion,—with the exception of the agent suggested in the report,—possesses that combination of properties which could warrant us in recommending it to the Metropolitan Board of Works, for the deodorization of the London sewage.

THE WESTMINSTER CLOCK.

The following further correspondence has appeared in *The Times* on this subject:—

Sir,—Owing to the irrelevancy of the greater portion of Mr. Denison's letter in *The Times* of yesterday, and the general tone of it, I do not propose to do more in this letter than substantiate the statements contained in my former one. Mr. Denison says, "To his (Sir Charles Barry's) statements that I approved those hands, as ultimately made by him, and that I fixed them, or saw them before they were fixed, or had anything whatever to do with the fixing, I give the flattest contradiction within the compass of the English language."

In reply, I subjoin a copy of a declaration of those who were employed in making and fixing the hands of the clock, under Mr. Denison's control and direction, the original of which was forwarded to the Office of Works on the 14th of July last:—

"We the undersigned, who have been employed in executing the work of the hands of the great clock of the New Palace at Westminster, do hereby declare that we have throughout acted under the directions of Mr. Denison in that work, and that after having submitted to that gentleman two pattern minute hands, exhibiting various modifications for lightening the weight, we succeeded in producing a hand which he said entirely met his wishes. He also said that he did not imagine that they could have been made so light in weight, and desired that the remaining three hands might be proceeded with, in accordance with it in all respects.

"Thomas Quarm, Clerk of Works.
"Jabez James, Engineer and Contractor for the Hands, Broadwall.
"Henry Hart, Foreman to Mr. James."

On the subject of weight the following declaration was forwarded to the Office of Works on the same day:—

"We the undersigned, having this day witnessed the weighing of one of the minute hands of the great clock of the New Palace at Westminster, do hereby declare the weight of that hand, and its external appurtenance, the counterpoise, to be as follows:—

	Cwt.	qrs.	lbs.
Entire weight of hand and counterpoise.	2	1	22
Weight of counterpoise beyond the axis of the arbor or spindle (deducted) ...	1	0	25
Net weight of the hand	1	0	25

"Charles Barry.
"Thomas Quarm, Clerk of Works.
"J. James, Engineer and Contractor, Broadwall.
"Henry Hart, Foreman to Mr. James."

If it be true, as Mr. Denison alleges, that Mr. Dent is able to give credit to the Government for 26 cwt. of old gun metal, lead, and iron, out of what he is pleased to term my minute hands, all I can say is that above 16 cwt. of that weight consists of cumbrous additions made to the hands by Mr. Denison himself as internal counterpoises. The excessive weight of such internal counterpoises caused so much torsion in the arbor, which is a piece of gas tubing only, about 9 feet long and 2¾ inches in diameter, that the hands could not be made to work, and after repeated trials of them by Mr. Denison himself they were condemned altogether.

Further evidence can be adduced, if necessary, on this subject; but I think I have said enough to enable the public to judge whether Mr. Denison was not concerned in both the preparation and the fixing of the hands, and whether, therefore, he is not as responsible for them as he is for all other going parts of the clock.

Yours faithfully,
CHARLES BARRY.

Old Palace-yard, Aug. 26.

Sir,—I have a short but tolerably decisive answer to give to Sir C. Barry and all his certificates from the people who did the hand business for him.

The hand and tail, or partial external counterpoise, which constitute the whole weight to be moved outside the dial, and of which he got my approval in 1857 (subject to the question of their being found strong enough), weighed 1 cwt. 2 qr. 14 lb., and consisted of gun metal only.

It seems that he did afterwards find them too weak, as I told him I believed he would, in spite of all the assurances of himself and his engineers to the contrary; and then, without letting me know anything about it, he began patching them up with copper at the back of the hand and adding lead to the tail, till they reached nearly 3 cwt., and required 3½ cwt. more of the short counterpoises inside to complete the balance.

The statement that I made the counterpoises would do him no good if it were true, because the weight of the hands, of course, fixed that of the counterpoises, but it is simply false besides.

His figure of 1 cwt. 25 lb. as the weight of the hand without the tail is equally irrelevant, as that is a merely arbitrary division of the external mass into two parts, both of which equally produce the friction to be overcome by the clock; and, as their lengths are very different, they do not balance each other, though the weight looks the same on paper; and even that is gratuitously wrong also, for he has omitted the lead or something else.

There is now lying at Westminster a cast-iron hand, his first essay in the art, which certainly had the merit of being strong enough; but I at once rejected it, as being at least twice the proper weight. That weighed under 5 cwt., with its complete counterpoise; and yet he has the face to say that I afterwards approved a weaker hand, weighing with its counterpoises 6½ cwt.

He knows also that I always told him the right way was to make the hands as thin tubes, as the new ones are; and that so made the whole weight need not exceed 2 cwt., which is exactly the weight of the new ones completely counterpoised.

The long and short of the matter is that, as usual, he made every blunder that lay open to him, and grossly deceived me into the bargain, by getting my consent to a pattern lighter than the one I had first condemned, and then secretly altering it into one much heavier and in every respect worse.

If he has any more to say I shall not be able to return his fire with the usual velocity, as I am going into the north to-day, having already lost three weeks of the long vacation by staying here to see his blunders put in train for being cured as far as possible.

May I take this opportunity of adding that several musicians of great eminence assure me that the new Big Ben is very superior in tone to the old one, which deviated from the pattern I had given? One of them says he considers it the finest bell in Europe. This, however, is a matter of musical opinion, which I do not feel competent to discuss myself; but after all that has been said to the contrary, by persons not much more competent, it is a fact which ought to be known.

So, with due thanks for the space you have kindly afforded me,

I remain, Sir, yours obediently,
E. B. DENISON.

Aug. 27.

Sir,—I am at a loss to discover in Mr. Denison's letter in *The Times* of this day any "decisive" or even intelligible reply to my statements; but I am glad to find that he no longer denies having ever seen or had anything to do with the minute hands, which he has now condemned as useless. I am content, therefore, to leave the matter as it now stands, and have no wish to intrude further upon your columns in making any remarks upon the gratuitous and unfounded assertions and insinuations as regards myself which are contained in his present and former letters.

I am, Sir, yours faithfully,
CHARLES BARRY.

Old Palace-yard, Aug. 29.

WATER-GLASS.

The following communication on this subject has been addressed to the Editor of the *Athenæum*:—

"Upper Holloway, August, 1859.

"The interesting articles that have lately appeared in the *Athenæum* upon water-glass, have afforded what I believe to be the solution of a difficult problem—viz., the formation of 'Beekites' (so called from the late Dr. Beeke, Dean of Bristol, who first drew attention to them), and for which I beg the favour of a small space in your columns.

"As from the very limited distribution of these quasi-fossils many of your readers may not be familiar therewith, I will, by permission, in the first place briefly describe these from my own observations and chemical analyses, referring those who may desire further particulars to a paper by Mr. Pengelly, read at the meeting of the British Association, at Cheltenham, in 1856.

"Rambling last autumn upon the rocks of Livermead Head, in Torbay, I found objects which I at first supposed, from their external character, were fragments of fossil madrepore. Upon closer inspection, however, their difference was obvious. The Beekite is not exactly a fossil, but an incrustation of chalcedony upon a nucleus of coral, and occasionally, but rarely, upon fragments of limestone. The chalcedony is deposited in concentric circles around minute tubercles. These are very sharply defined in the Beekites that are freshly dug out of the cliff above high-water mark,—but if picked up on the beach, or taken from the cliff where tidewashed, they are smoother and have lost much of their peculiar features. In size the Beekite varies very much; I have found many of the size of beans. I have a very beautiful specimen as large as a fist, and another less perfect nine or ten inches in length. Mr. Pengelly has found them of a foot in diameter. Their form is irregular; most commonly they are more or less round. They take their shape from the fragments of coral upon which the chalcedony has been deposited, and which having become more or less decomposed and disintegrated the chalcedony forms a kind of shell or case inclosing its remains. The coral within is found in various stages of decomposition, in some filling the interior, in others nearly so, allowing so much movement that when shaken the contents may be heard to rattle; in others the coral is so completely broken down that only a powder, consisting of the carbonate of lime and some brown particles of organic matter, remain. The interior of the silicious shell has often the markings of the original coral; in the majority of the specimens which I have examined, the interior has been simply irregularly modulated or granulated.

"Having submitted a Beekite weighing 1,040 grains to chemical analysis, I obtained the following results:—Carbonate of lime, 470 grains; chalcedony, 540; peroxide of iron and alumina, derived from the red conglomerate whence it was taken, 5; carbonaceous matter, residue of animal matter of coral, 25 grains.

"A very remarkable feature in the history of Beekites is, that they are not found in the rocks beyond Torbay, and that they are most abundant in limited portions even of that district—*e. g.*, Livermead and Paignton. Mr. Pengelly has searched other beds of conglomerate throughout Devonshire, and has not met with them elsewhere. I searched the cuttings of the new Dartmouth Railway without success. It was stated during the discussion at the British Association, that true Beekites had been found in Australia, on the banks of the Nerbuddah in India, in the north of Scotland, and near Lidcot in Somersetshire. They have been, however, but few in number and very sparsely scattered. That they should be thus scarce and local is certainly a very curious circumstance. The shores and cliffs of Torbay consist of the conglomerate, or ancient beaches, formed from the New Red Sandstone: among the fossils of which corals predominate. Fragments of coral may often be found without the silicious crust of chalcedony. Other fossils, it may be observed, are scarce in the conglomerates of Torbay.

"The problem offered by these objects was, how they could have obtained their silicious crust, lying as they do in a conglomerate of a loose character, free from silicious cement. It is clear that the crust of chalcedony must have been deposited *in situ*, otherwise, the Beekites would present the evidences of water-wear, equally with the pebbles of the conglomerate in which they are found. Doubtless, as Mr. Pengelly suggested, the coral was in a state of decomposition before the deposition of chalcedony commenced. Still it remained a puzzle to account for the presence of silicious matter on these fragments of coral, to the exclusion of the surrounding fragments of rock. The difficulty, it appears to me, is got over by the recent researches upon soluble silicates. In the report of the Commission of the French Academy of Sciences [*Athen.*, No. 1,653], it is suggested that flint-stones, agates, petrified woods, and other silicious infiltrations owe their formation to a slow decomposition of alkaline silicate by carbonic acid. Mr. Ransome, in a later communication, states that the presence of a chloride renders still more certain and durable the silicification. We have, then, thus placed before us precisely the conditions under which Beekites would be formed. Fragments of coral, broken by the waves and deposited with the beach, now constituting rocks of red conglomerate, would retain a certain proportion of chlorides, while their decomposition would liberate the carbonic acid, which would separate the alkaline constituent of silicious springs, and cause the deposition of silica upon the nucleus of coral. That a similar silicious deposition is not found upon the surrounding deposit is satisfactorily explained by the non-liberation of carbonic acid from the pebbles, into the composition of which its elements did not enter. This view is strengthened by the fact of the non-silicification of the nucleus itself, the silicate being arrested on its surface by the escape of carbonic acid. Furthermore, where chalcedony presenting the Beekite characters has been found upon stone, it has been limestone, from which it is possible carbonic acid may have been disengaged at the time of deposition. The characters of chalcedony, as presented in the Beekites, moreover, approach very closely to those of the silicious incrustations of the Geyser springs in Iceland.

"W. B. KESTEVEN, F.R.C.S."

PARLIAMENTARY REPORTS.

SESSIONAL PRINTED PAPERS.

PAR. NO.

Delivered on 6th August, 1859.

140. Norwich Election—Minutes of Evidence.
132. Cambridge University (Scholarships of St. John's College)—Copies of Two Statues.
113. Bills—Cottages (Scotland).
114. ,, Corrupt Practices Prevention Act (1854) Continuance.
115. ,, Inclosure Acts Amendment.
116. ,, Stock in Trade Exemption.
117. ,, Ecclesiastical Jurisdiction Continuance.
119. ,, Inclosure.
Revision of Consular Fees—Report on Mr. Murray's Plan.

Delivered on 8th August, 1859.

130. County Treasurers (Ireland)—Account.
153. New Foreign and Indian Offices—Further Return.
127. Gloucester Election—Minutes of Evidence.
118. Bills—Episcopal and Capitular Estates Act Continuance.
120. ——— Law of Property and Trustees Relief (amended).
121. ——— Charitable Trusts Acts Continuance.
122. ——— European Troops (India).
123. ——— Marriages (Lisbon).
124. ——— Reserve Volunteer Force of Seamen (amended).
125. ——— Stamp Duties (amended).
Hudson's Bay Company's Charter and Licence of Trade—Papers.

Delivered on 10th August, 1859.

131. Divorce and Matrimonial Causes—Return.
142. Letters of Detention—Abstract of Return.
154. East India (Debt, &c.)—Return.
108. East India—Territorial Accounts.
126. Bill—Sale of Gas (amended).

Delivered on 11th August, 1859.

141. Aylesbury Election—Minutes of Evidence.
111. Bills—Tramways (Ireland) (amended).
112. ,, Public Charities.

Delivered on 12th August, 1859.

151. Treasury Chest—Account.
160. Army (Infantry and Cavalry)—Return.
161. Army (Foot Guards and Infantry of the Line)—Return.
181. The Serpentine—Copy of Mr. Hawksley's Letter.
147. Limerick City Election—Minutes of Evidence.
127. Bill—Masters and Operatives.
Births, Deaths, and Marriages (England)—20th Report of the Registrar General.
Poor Law Board—11th Annual Report.

Delivered on 13th August, 1859.

133. County Rates (Ireland)—Return.
148. Trinity House Pilots (Port of London)—Return.
150. Fisheries (Ireland)—Copy of Mr. Stopford's Letter.
169. Factories Regulation Acts—Return.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August 26th*, 1859.]

Dated 30th July, 1859.

1768. A. B. Seithen, 6, Alpha-place, Caledonian-road—Imp. in cases or boxes, and in casings, hampers, baskets, and wrappers for holding bottles, jars, and other articles.

Dated 1st August, 1859.

1778. E. Merrell, Little George-street, Minories—Imp. in apparatus for washing and cleansing.

Dated 4th August, 1859.

1800. E. J. Cordner, Derramore, Ireland—Imp. in the application of kites to the saving of life and property from shipwreck, and to other purposes.

Dated 5th August, 1859.

1808. R. T. Pattison, Daldorch, Ayr, Scotland—Imp. in dyeing certain woven fabrics.

Dated 8th August, 1859.

1822. J. Cunningham, Paisley—Imp. in and connected with Jacquard apparatus for weaving.
1824. R. A. Brooman, 166, Fleet-street—Improved means of preventing incrustations in steam boilers. (A com.)
1826. L. B. Ollivier, 29, Boulevart St. Martin, Paris—Imp. in closing or stoppering bottles, jars, and other receptacles.
1827. B. Baugh, Birmingham—Certain imp. in the mode and apparatus for partially forming, and finishing the edges of certain description of vessels formed or raised from sheet iron or other metal.
1828. J. H. Johnson, 47, Lincoln's-inn-fields—An improved signal light, and in the apparatus employed in the production thereof. (A com.)
1830. G. T. Bousfield, Loughborough-park, Brixton—Imp. in revivifying the scarlet colour of woollen cloth, lace, and embroidery, in use for military and other garments and furniture. (A com.)
1832. J. B. Babcock, 35, Milk-street, Boston, U.S.—Imp. in umbrellas and parasols. (A com.)

Dated 9th August, 1859.

1834. N. Kenward, Sutton, Surrey—Imp. in constructing tubular steam boilers.
1836. J. Cannon, Billiter-street—Imp. in washing machines. (A com.)
1838. C. L. J. Dierickx, Paris—A new system of scales, to be used principally in the fabrication of coins.
1844. W. Williamson, High Holborn—An improved machine or tool for drilling holes.
1846. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in destroying noxious exhalations. (A com.)

Dated 10th August, 1859.

1850. T. A. Temperton, Manchester—Imp. in pipes for smoking tobacco.
1852. G. Capper, Bidborough-street, New-road, Middlesex—Imp. in the permanent way of railways.
1854. J. J. Speed, jun., Detroit, U.S.—Imp. in the manufacture of pipes, tubes, and hollow cylinders.

Dated 11th August, 1859.

1855. R. Heaton, jun., and G. Heaton, Birmingham—Imp. in coining machinery.
1857. J. T. Pitman, 67, Gracechurch-street—A composition applicable to the lubrication of machinery and to various other uses. (A com.)
1858. W. Bouch, Shildon, Durham—Imp. in breaks, in buffers, and in couplings to be used on railways.
1859. D. Hulett, 55 and 56, High Holborn, and G. Prudden, Shefford, Beds—Imp. in apparatus for the manufacture and distribution of gas, and in apparatus applicable for internal or external illumination.
1860. W. De la Rue, and Dr. H. Muller, 110, Bunhill-row, Middlesex—Imp. in treating Japan and other vegetable wax.

Dated 12th August, 1859.

1862. W. Clark, 53, Chancery-lane—Certain imp. in oscillating engines. (A com.)
1863. A. Evaux, 206, Regent-street—Artificial marbles.
1864. W. H. Tooth, 3, Spring-terrace, Wandsworth-road—Imp. in the mode of cleaning or laying the dust of pavements, roads, or other surfaces.
1865. J. Philp, Camden-town—An improved hobby-horse or child's exerciser.

Dated 13th August, 1859.

1867. D. Campbell, 7, Quality-court, Chancery-lane—Imp. in the preparation of oils for medicinal and other purposes.
1868. J. Brown, 8, Exeter-place, Walham-green, Middlesex—Improving false shirt fronts.
1870. W. Green, Kidderminster, W. Fawcett, and F. R. Fawcett, Wolverley, Worcestershire—Imp. in the manufacture of rugs.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, August 26th*, 1859.]

2058. G. Anderson.

[*From Gazette, August 30th*, 1859.]

August 26th.

2006. B. A. Grautoff and C. H. W. Albrecht.
2007. T. Watson.
2102. C. Brook, jun.

August 27th.

2023. J. Gregory.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 9, 1859.

EXAMINATIONS, 1859.

The Prizes and Certificates awarded at the Society's Examinations, held in May last, have been forwarded to the Local Boards for distribution among the successful candidates.

BRITISH ASSOCIATION MEETING.

The Great Northern and London and North Western Railway Companies have agreed to issue first-class return tickets at £5 each, from King's-cross or Euston-square to Aberdeen and back, available from Monday, the 12th, till Friday, the 30th inst., inclusive, to persons presenting a card issued by the authorities of the British Association, and which may be obtained of Messrs. Taylor and Francis, Red Lion-court, Fleet-street.

Passengers holding these tickets will be allowed to stop one night on the journey, under the same regulations as ordinary first-class passengers.

EXAMINATION PAPERS, 1859.

(*Concluded from page* 660.)

The following are the Examination Papers set in the various subjects at the Society's Final Examinations, held in May last :—

LATIN AND ROMAN HISTORY.

THREE HOURS ALLOWED.

Candidates are not allowed to work more than *two* out of the *four* Sections into which this Paper is divided, and are not expected to answer more than six questions in Section III. or IV.

Section I.

Translate literally into English prose :—

Itaque Hannibal, postquam ipsi sententia stetit pergere ire atque Italiam petere, advocata concione varie militum versat animos castigando adhortandoque: mirari se, quinam pectora semper impavida repens terror invaserit; per tot annos vincentes eos stipendia facere, neque ante Hispania excessisse quam omnes gentesque et terrae eae, quas duo diversa maria amplectantur, Carthaginiensium essent. indignatos deinde, quod quicumque Saguntum obsedissent, velut ob noxam sibi dedi postularet populus Romanus, Hiberum trajecisse ad delendum nomen Romanorum liberandumque orbem terrarum. tum nemini visum id longum, cum ab occasu solis ad ortum intenderent iter: nunc, postquam multo majorem partem itineris emensam cernant, Pyrenaeum saltum inter ferocissimas gentes superatum, Rhodanum tantum amnem tot milibus Gallorum prohibentibus domita etiam ipsius fluminis vi trajectum, in conspectu Alpes habeant, quarum alterum latus Italiae sit, in ipsis portis hostium fatigatos subsistere — quid Alpes aliud esse credentes quam montium altitudines? fingerent altiores Pyrenaei jugis; nullas profecto terras caelum contingere nec inexsuperabiles humano generi esse; Alpes quidem habitari, coli, gignere atque alere animantes; pervias paucis esse et exercitibus. eos ipsos, quos cernant, legatos non pinnis sublime elatos Alpes transgressos. ne majores quidem eorum indigenas, sed advenas Italiae cultores has ipsas Alpes ingentibus saepe agminibus cum liberis ac conjugibus migrantium modo tuto transmisisse.

(1.) Parse fully ipsi—concione—Carthaginiensium—trajecisse—prohibentibus—fingerent—elatos.

(2.) Why is amplectantur in the subjunctive mood? Are there any other verbs in the passage put in the subjunctive mood for the same reason?

(3.) Explain the phrases stipendia facere—ob noxam.

(4.) Give a brief abstract of the causes of the war and of its progress up to this point.

Section II.

Translate into English prose :—

Sic animis juvenum furor additus: inde, lupi ceu
Raptores atra in nebula, quos improba ventris
Exegit caecos rabies, catulique relicti
Faucibus exspectant siccis, per tela, per hostes
Vadimus haud dubiam in mortem, mediaeque tenemus
Urbis iter. Nox atra cava circumvolat umbra.
Quis cladem illius noctis, quis funera fando
Explicet, aut possit lacrimis aequare labores?
Urbs antiqua ruit, multos dominata per annos;
Plurima perque vias sternuntur inertia passim
Corpora perque domos et religiosa deorum
Limina. Nec soli poenas dant sanguine Teucri;
Quondam etiam victis redit in praecordia virtus,
Victoresque cadunt Danai. Crudelis ubique
Luctus, ubique pavor et plurima mortis imago.

(1.) Pars fully animis—cœcos—faucibus—fando—lacrimis—victis.

(2.) Explain mediæ urbis. What other adjectives besides medius are used in the same way?

(3.) Conjugate exegit, tenemus, explicet, sternuntur, dant, cadunt.

(,4.) Give the genitive singular of furor, rabies, mortem, ter nox, inertia, corpora, soli, præcordia, imago.

Section III.

(1.) Explain the nature and powers of the Comitia Curiata, Centuriata, and Tributa.

(2.) Give an account of Genucius, Terentilius, Publilius, and Licinius.

(3.) What was the object of the first Decemvirate and what of the second? Give an account of the circumstances which led to the abolition of the latter.

(4.) Explain the nature of the Agrarian Laws.

(5.) Give an account of the first Punic war.

(6.) Give an outline of the successive steps by which the Romans became masters of all Italy.

(7.) What are the duties and the powers of a Consul, a Censor, a Prætor, a Quæstor, and a Curule Ædile?

(8. Mention the dates of the capture of Rome by the Gauls, the capture of Saguntum by the Carthaginians, the battle of Cannæ, the invasion of Italy by Pyrrhus, the destruction of Carthage.

Section IV.

(1.) Give an account of the Social War.

(2.) Write a character of Marius. To what political party did he belong? and what appears to have been the aim of his policy, as far as he had any?

(3.) Write a short life of Cicero. Describe particularly his mode of dealing with the conspiracy of Catiline.

(4.) What distinction was made at the time of Augustus between provinces governed by the authority of the Emperor and those governed by the authority of the Senate?

(5.) What were the chief privileges of a Roman citizen?

(6.) At what time did the Romans begin to form a navy? Mention the most important naval battles in Roman history.

(7.) At what dates and by what means did the Romans become possessed of Sicily, Spain, Peloponnesus, Egypt.

(8.) What offices did Augustus unite in his own person and for what purpose?

FRENCH.

THREE HOURS ALLOWED.

I.

Translate into English *any two and not more than two*, of the following extracts; and answer (in French, if possible) the questions respectively appended to each of those two extracts.

(1.) From Corneille's *Le Cid.* (Acte II, Scène 2) :—

D. Rodrigue.

Parle sans t'émouvoir.
Je suis jeune, il est vrai; mais aux âmes bien nées
La valeur n'attend pas le nombre des années.

D. Gomès.

Te mesurer à moi! Qui t'a rendu si vain,
Toi qu'on n'a jamais vu les armes à la main?

D. Rodrigue.

Mes pareils à deux fois ne se font pas connaître,
Et pour leurs coups d'essai veulent des coups de maître.

D. Gomès.

Sais tu bien qui je suis?

D. Rodrigue.

Oui; tout autre que moi
Au seul bruit de ton nom pourrait trembler d'effroi.
Les palmes dont je vois ta tête si couverte
Semblent porter écrit le destin de ma perte.
J'attaque en téméraire un bras toujours vainqueur;
Mais j'aurai trop de force, ayant assez de cœur.
A qui venge son père il n'est rien d'impossible;
Ton bras est invaincu, mais non pas invincible.

D. Gomès.

Ce grand cœur qui paraît aux discours que tu tiens
Par tes yeux, chaque jour, se découvrait aux miens;
Et, croyant voir en toi l'honneur de la Castille,
Mon âme avec plaisir te destinait ma fille.
Je sais ta passion, et suis ravi de voir
Que tous ses mouvements cèdent à ton devoir,
Qu'ils n'ont point affaibli cette ardeur magnanime,
Que ta haute vertu répond à mon estime;
Et que, voulant pour gendre un cavalier parfait,
Je ne me trompais pas au choix que j'avais fait.
Mais je sens que pour toi ma pitié s'intéresse;
J'admire ton courage, et je plains ta jeunesse;
Ne cherche point à faire un coup d'essai fatal;
Dispense ma valeur d'un combat inégal.
Trop peu d'honneur pour moi suivrait cette victoire:
A vaincre sans péril, on triomphe sans gloire.
On te croirait toujours abattu sans effort,
Et j'aurais seulement le regret de ta mort.

D. Rodrigue.

D'une indigne pitié ton audace est suivie:
Qui m'ose ôter l'honneur craint de m'ôter la vie!

* * * * * * * *

D. Gomès.

Viens, tu fais ton devoir; et le fils dégénère
Qui survit un moment à l'honneur de son père.

a. Give a biographical sketch of P. Corneille, with the names of his principal plays.

b. Explain briefly the plot of *Le Cid.*

(2.) From Voltaire's *Siècle de Louis XIV.* (Chap. XVII.) :—

Guillaume III laissa la réputation d'un grand politique, quoiqu'il n'eût point été populaire, et d'un général à craindre, quoiqu'il eût perdu beaucoup de batailles. Toujours mesuré dans sa conduite, et jamais vif que dans un jour de combat, il ne régna paisiblement en Angleterre que parcequ'il ne voulut pas y être absolu. On l'appelait, comme on sait, le Stathouder des Anglais, et le Roi des Hollandais. . . . Son caractère était en tout l'opposé de Louis XIV.: sombre, retiré, sévère, sec, silencieux, autant que Louis était affable. . . .

Ceux qui estiment plus le mérite d'avoir défendu sa patrie, et l'avantage d'avoir acquis un royaume sans aucun droit de la nature, de s'y être maintenu sans être aimé, d'avoir gouverné souverainement la Hollande sans la subjuguer, d'avoir été l'âme et le chef de la moitié de l'Europe, d'avoir eu les ressources d'un général et la valeur d'un soldat, de n'avoir jamais persécuté personne pour la religion, d'avoir méprisé toutes les superstitions des hommes, d'avoir été simple et modeste dans ses mœurs; ceux-là sans doute donneront le nom de grand à Guillaume plutôt qu'à Louis. Ceux qui sont plus touchés des plaisirs et de l'éclat d'une cour brillante, de la magnificence, de la protection donnée aux arts, du zèle pour le bien public, de la passion pour la gloire, du talent de régner; qui sont plus frappés de cette hauteur avec laquelle des ministres et des généraux ont ajouté des provinces à la France sur un ordre de leur roi; qui s'étonnent davantage d'avoir vu un seul Etat résister à tant de puissances; ceux qui estiment plus un roi de France qui sait donner l'Espagne à son petit fils, qu'un gendre qui détrône son beau-père; enfin ceux qui admirent davantage le protecteur que le persécuteur du roi Jacques, ceux-là donneront à Louis XIV la préférence.

a. State what you know of the life and works of Voltaire, and what you think of the influence of his writings on his age and country.

b. What portion of history does the *Siècle de Louis XIV* embrace, and in how many distinct periods may it be divided?

(3.) From Montesquieu's *Grandeur et Décadence des Romains*, (Chap. 1) :—

Rome était dans une guerre éternelle et toujours violente: or, une nation toujours en guerre, et par principe de gouvernement, devait nécessairement périr, ou venir à bout de toutes les autres, qui, tantôt en guerre, tantôt en paix, n'etaient jamais si propres à attaquer, ni si préparées à se défendre. Par là, les Romains acquirent une profonde connaissance de l'art militaire. Dans les guerres passagères, la plupart des exemples sont perdus; la paix donne d'autres idées, et on oublie ses fautes et ses vertus mêmes.

Une autre suite de ce principe de la guerre continuelle fut que les Romains ne firent jamais la paix que vainqueurs: en effet, à quoi bon faire une paix honteuse avec un peuple pour en aller attaquer un autre?

Dans cette idée, ils augmentaient toujours leurs prétentions à mesure de leurs défaites: par là ils consternaient les vainqueurs, et s'imposaient à eux-mêmes une plus grande nécessité de vaincre.

Toujours exposés aux plus affreuses vengeances, la constanceet la valeur leur devinrent nécessaires; et ces vertus ne purent être distinguées chez eux de l'amour de soi-même de sa famille, de sa patrie, et de tout ce qu'il y a de plus cher parmi les hommes.

Les peuples d'Italie n'avaient aucun usage des machines propres à faire les sièges; et, de plus, les soldats n'ayant point de paye, on ne pouvait pas les retenir long-temps devant une place: ainsi peu de leurs guerres étaient décisives. On se battait pour avoir le pillage du camp ennemi ou de ses terres; après quoi le vainqueur et le vaincu se retiraient, chacun dans sa ville. C'est ce qui fit la résistance des peuples d'Italie, et en même temps l'opiniâtreté des Romains à les subjuguer; c'est ce qui donna à ceux-ci des victoires qui ne les corrompirent pas, et qui leur laissèrent toute leur pauvreté.

a. Give a biographical sketch of Montesquieu. Name his principal works.

b. State briefly what Montesquieu considers to be the most important causes of the decline of Rome.

(4.) From de Tocqueville's *L'Ancien Régime et la Révolution* (Chap. I.) :—

Imaginez-vous, je vous prie, le paysan français du dix-huitième siècle, ou plutôt celui que vous connaissez; car c'est toujours le même: sa condition a changé, mais non son humeur. Voyez-le tel que les documents que j'ai cités l'ont dépeint, si passionnément épris de la terre qu'il consacre à l'acheter toutes ses épargnes et l'achète à tout prix. Pour l'acquérir il lui faut d'abord payer un droit, non au gouvernement, mais à d'autres propriétaires du voisinage, aussi étrangers que lui à l'administration des

affaires publiques, presque aussi impuissants que lui. Il le possède enfin: il y enterre son cœur avec son grain. Ce petit coin du sol qui lui appartient en propre dans ce vaste univers le remplit d'orgueil et d'indépendance. Surviennent pourtant les mêmes voisins qui l'arrachent à son champ et l'obligent à venir travailler ailleurs sans salaire. Veut-i défenbre sa semence contre leur gibier; les mêmes l'en empêchent, les mêmes l'attendent au passage de la rivière pour lui demander un droit de péage. Il les retrouve au marché, où ils lui vendent le droit de vendre ses propres denrées; et quand rentré au logis, il veut employer à son usage le reste de son blé, de ce blé qui a crû sous ses yeux et par ses mains, il ne peut le faire qu'après l'avoir envoyé moudre dans le moulin et cuire dans le four de ces mêmes hommes. C'est à leur faire des rentes que passe une partie du revenu de son petit domaine, et ces rentes sont imprescriptibles et irrachetables.

Quoi qu'il fasse, il rencontre partout sur son chemin ces voisins incommodes, pour troubler son plaisir, gêner son travail, manger ses produits; et, quand il a fini avec ceux-ci, d'autres, vêtus de noir, se présentent, qui lui prennent le plus clair de sa récolte. Figurez-vous la condition, les besoins, le caractère, les passions de cet homme, et calculez, si vous le pouvez, les trésors de haine et d'envie qui se sont amassés dans son cœur.

a. State what you know of the late M. de Tocqueville's career. What is his great work, besides *L'Ancien Régime et la Révolution ?*

b. Name briefly the principal causes to which M. de Tocqueville ascribes the Revolution of 1789.

II.

1. Mention briefly, with dates, the most important events of the reign of Louis IX.

2. Sketch in French the most striking features of the character and administration of Richelieu.

III.

Write a letter in French, of about fifteen lines, upon any subject you please, with as many idiomatic expressions as possible.

GERMAN.

THREE HOURS ALLOWED.

Section I.

Translate from German into English.

Each candidate is expected to translate one of the following passages, and to answer a few of the grammatical questions appended to to the first.

(1). Friedrich bedurfte keiner langen Vorbereitung, um sich, zur Erwerbung seines Rechtes, auf einen kriegerischen Fusz zu setzen. Sein Plan ward nur wenigen Vertrauten mitgetheilt. Aber die ungewöhnlichen Bewegungen, die auch zu dieser Vorbereitung nöthig waren, die Truppenmärsche, Artilleriezüge, die Einrichtung der Magazine und dergleichen gaben es kund, dasz irgend ein groszes Unternehmen im Werke war. Alles ward von Staunen und von Neugier erfüllt; die verschiedensten Gerüchte brachte man in Umlauf; die Diplomaten sandten und empfingen Couriere, ohne mit Bestimmtheit den Plan des Königs errathen zu können. Absichtlich hatte dieser einige Truppenmärsche so angeordnet, dasz man vorerst eher an eine Rhein-Campagne, wegen Jülich und Berg, als an Schlesien dachte. Die verkehrtesten Meinungen, die im Publikum herüber und hinüber wogten, ergötzen ihn sehr. "Schreib mir viel Possierliches," so hiesz es in einem Briefe Friedrich's an Jordan, "was man sagt, was man denkt, und was man thut."

Grammatical Questions.

(*a.*) Give the infinitives, past participles, and present indicative of *bedurfte*, *gaben*, *brachte*, *sandten*, and *empfingen*.

(*b.*) State the difference of meaning of *setzen* and *sitzen;* also of *stehen* and *stellen*, *legen* and *liegen*, *sinken* and *senken*, *ertrinken* and *ertränken;* and mention the irregularities belonging to some of these verbs.

(*c.*) Why is *einen kriegrischen Fusz* not in the dative? State the rule which governs this preposition as to its cases, and mention the other prepositions which come under the same rule.

(*d.*) Give the nominative and genitive singular of *Bewegungen*, *Truppenmärsche*, *Artilleriezüge* and *Gerüchte.*

(*e.*) Give the infinitive, the present, imperfect, and imperative of *mitgetheilt.*

(*f.*) Give the genitive case of all the personal pronouns.

(*g.* Why is *war*, in the third sentence, at the end?

(*h.*) Why is the nom. *dieser*, in the fifth sentence, after the verb?

2. Ist mein Gewissen gegen diesen Staat
Gebunden? Hab'ich Pflichten gegen England?
Ein heilig Zwangsrecht ûb' ish aus, da ich
Aus diesen Banden strebe, Macht mit Macht
Abwende, alle Staaten dieses Welttheils
Zu meinem Schutz aufrühre und bewege.
Was irgend nur in einem guten Krieg
Recht ist und ritterlich, das darf ich üben.
Den Mord allein, die heimlich blut'ge That
Verbietet mir mein Stolz und mein Gewissen;
Mord würde mich befleken und entehren.
Entehren, sag'ich—keinesweges mich
Verdammen, einem Rechtsspruch unterwerfen.
Denn nicht vom Rechte, von Gewalt allein
Ist zwischen mir und Engelland die Rede.

Section II.

Translation from English into German. Not more than ten of the following passages are to be translated by each candidate. The answers are to be written in English or German character, but as distinctly as possible.

1. He dined with me at my hotel.
2. He has never dined with us (viz., at our house).
3. She trembled with cold.
4. With such a noise, I cannot hear.
5. Will you take this letter with you for me?
6. Sit down and play for me.
7. I never play at cards for money.
8. What do you use this machine for?
9. I do not know what it is used for.
10. Why did you allow this trifling dispute to come a law-suit?
11. I did not let it come to it. It was brought to it by my attorney.
12. Not having any interest in it myself, I left it entirely to him, relying on his good sense, knowledge of the law, and integrity.

(13.) I am just having a book printed which I wrote last year, while I was travelling on the Continent.

(14.) I remember, you were engaged upon it, when I met you at Milan, on my way to the East.

(15.) When it is finished, I shall have much pleasure in sending you a copy of it.

(16.) Why do you copy this?

(17.) It is so indistinctly written, that I am afraid I shall have to copy nearly the whole work before I send it to the printer.

18. The opinions of men are not always the same.

19. If human opinions were always the same, and the same in all men; and if it were indifferent to men what opinions others entertain, there would not be so many divisions, quarrels, and wars in the world.

(20.) It had been determined by the father that, in case one of the brothers should, after his death, leave the paternal house, he who went away should receive half the property which had accumulated in the family within a century.

(21.) If he had been an only son, his right of inheritance would not have been doubtful a moment.

(22.) He did not wish to make a difference among his sons, and therefore would not allow the right of primogeniture which prevails in noble families to have sway in his.

(23.) He used plausible arguments to prove his right.

MUSIC.

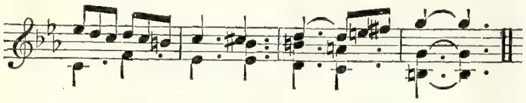
THREE HOURS ALLOWED.

Rudiments of Musical Grammar.

(1.) Can the scale or key of a piece of music be *always* known from the signature?

(2.) In how many ways can the *upper* tetrachord of a minor scale be written?

(3.) In what scale or key does the following passage begin and end?



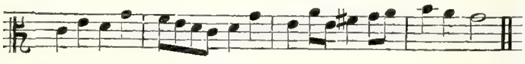
(4.) Does the presence of an accidental *always* imply modulation?

(5.) How many kinds of time essentially different from one another are there?

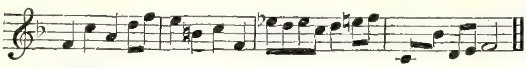
(6.) How does 6/8 time resemble, and how does it differ from, 3/4 time?

(7.) Explain the following terms:—Mode, interval, accent, tetrachord, accidental, crescendo, signature.

(8.) Write the following passage on the treble stave.



(9.) Transpose the following into the scale or key of *Re* (D).



(10.) Write any melody with which you are acquainted, from memory.

Harmony.

(1.) Give examples of contrary, oblique, and similar motion.

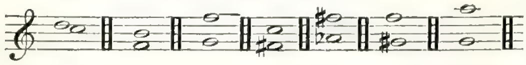
(2.) How does a discord by suspension differ from a fundamental discord?

(3.) How many kinds of *triad* are there?

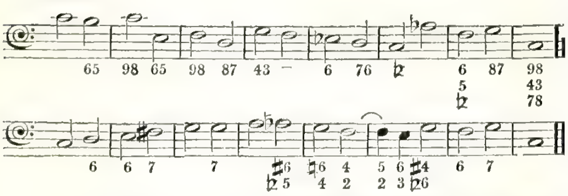
(4.) How many kinds of fundamental discord of the Seventh are there?

(5.) Of what intervals is the discord of the *dominant* Seventh composed? and why is so much importance attached to it by modern musicians?

(6.) Resolve the following intervals:—

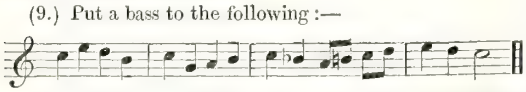


(7.) Add three parts to one or both of the following basses:—

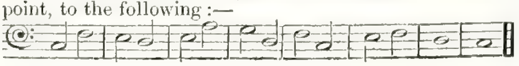


(8.) Give any rules or general principles for the succession of fundamental basses.

(9.) Put a bass to the following:—



(10.) Add one or more parts, in any species of counterpoint, to the following:—



THE *BOMBYX CYNTHIA*, OR *RICINUS* SILKWORM.

The following is the substance of a German pamphlet,* containing a report laid before a general meeting of the Acclimatisation Society of Prussia, on the 22nd of last October, by Herr Ernst Kauffmann, a vice-president of of the Society, on the recently-introduced *Bombyx Cynthia*,† or silkworm of the *Ricinus*. Having introduced the subject by a few prefatory sentences on the silk-producing insects, and the beauty of the fabrics derived from the labours of those diminutive creatures, the author enters into a concise statement of the different metamorphoses through which the common silkworm (*Bombyx Mori*) passes during its brief period of existence, tracing it from the egg (which he describes minutely as containing a yolk, white, &c., analogous to those of our domestic fowl), through the larva state, its several moultings or changes of skin, which in this stage occur five times, and which changes or moults frequently occasion serious losses to the breeder,—until it arrives at the pupa state, in which alone it becomes of utility to man; the perfect insect, after leaving the protection of the chrysalis, living only to continue the species. These details being sufficiently well-known, their repetition *in extenso* is unnecessary. It may, however, be as well to recall a fact, that it is seldom that more than one breed of the *Bombyx Mori* can be successfully reared in a season. Further south, indeed, the mulberry, if prudently divested of its leaves, will reproduce a quantity of foliage sufficient to supply a second brood with advantage; but in more northern latitudes, where nature is less favourable to vegetation, a profitable after-crop is scarcely to be expected, there being no available substitute on failure of the mulberry-leaf, and the cultivator must, therefore, be content with one brood of eggs only, of which every healthy female lays from four to five hundred.

The number of eggs laid by the *Bombyx Cynthia* seldom exceeds 300, but as the insect goes through the whole series of changes in about six weeks, it is possible to obtain, in the course of the year, no less than eight or nine broods from a single pair.

Let us now, says the author of the report, make an approximate estimate of the enormous quantity of cocoons to be derived from this single pair in so short a space of time—supposing their offspring to be supplied with the requisite amount of food and all necessary attention paid to them. It will not be found in practice—and on a large scale—that from every egg laid a cocoon will be produced. The common silk-worm loses, on an average, in each brood, from one-fourth to one-third of the original number. Let us assume the highest of these as the proportion for the *Ricinus* silkworm (although this latter is much the more healthy) and by making the deduction at the outset, the calculations will be simplified.

This deduction leaves one hundred couples as the first produce of the original pair. Proceeding in this manner with the calculation, it will be found that at the end of the year the descendants of this pair will reach to no less a number than ten thousand million million couples—and that the eggs of these latter will amount to the enormous sum of two million million million.

"Here," says the author of the report, "breath absolutely fails me, and I am happy to have done at length with enumerating the posterity of these two moths."

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* The title of the work at full length is as under:—"A Comparison between the Growth of Ricinus and Mulberry Silk, as regards their respective products; with remarks on some new Silk-producing Caterpillars. Being a Report delivered on the 22nd October, 1858, before a public meeting of the Prussian Acclimatisation Society. By Herr Ernst Kauffmann, Vice-President of the Society. Reprinted from the Society's Journal, at the express command of His Highness the Duke of Saxe Coburg Gotha."

† Communications in reference to the *Bombyx Cynthia* will be found in the *Journal*, Vol. vi., pp. 168, 460, 630, 641.

The author calculates that 3,300 empty cocoons are amply sufficient to yield one pound of silk—but he assumes that 4,000 would be required—and this would give 500 billion pounds of silk as the entire product of one couple. Assuming the population of Germany at 45 millions, this calculation at the year's end would allow more than ten million pounds to each individual; and many a poor wretch, who now shivers in the winter's cold, would have reason to be grateful to the first pair of moths for a warm and comfortable protection against the inclemency of the season.

In making this statement the author desires not to be misunderstood; he states his aim in bringing before the Society his moderate estimate of the prolific powers of the *Bombyx Cynthia*, to be simply to show how liberal in this, as well as in other instances, nature is of her favours, and in no way to maintain either the possibility or the expediency of rearing such an enormous number; for neither land nor labour could be spared to furnish the immense supply of vegetable matter which would be required for that purpose.

The silk-rearer, however, is at liberty either to discontinue his operations at the second or third generation, or to confine them to such a limited and determinate number as he may either find most profitable or convenient—the preceding figures being merely intended to show what is within the bounds of possibility.

The author then proceeds to make an estimate of the comparative value of the cocoon from the two species of silkworm:—

On examining one of the reddish-yellow, almond-shaped cocoons, of the *Bombyx Cynthia*, it will be seen that the insect, while preparing a convenient receptacle for its period of repose, has provided itself with a place of exit; the empty cocoons being scarcely distinguishable from those still containing a chrysalis, except by their comparative lightness.

With the cocoons of the *Bombyx Mori* the case is different, these being entirely closed—the escape of their inmates being effected by means specially provided for that purpose, but destructive of the cocoon. The insect must, therefore, be destroyed in order to save the silk. Such is not the case with the *Bombyx Cynthia*. The cocoons may be recognised by their oval figure, and by that even brilliant thread which is capable of being readily reeled off.

The process is somewhat more difficult with the cocoons of the *Bombyx-Pernyi*, or silkworm of the oak. The aid of chemistry must be called in to remove a tough, glutinous substance, with which the threads are, as it were, cemented. The reeling is, however, rendered possible.

The case is the same with the huge cocoons (still attached to the twigs on which they were spun) of the *Bombyx-Cecropia*, which feeds on the leaves of the weeping birch. In the spring of the year 1858, Herr Hensel received direct from America a parcel of cocoons of different species, from which the splendid moths exhibited by the author to the meeting were produced. It is to be regretted that, in this instance, more accurate observations were not made on this species—a neglect which, on a future occasion, care will be taken to remedy.

Very favourable results have been obtained in France from a smaller portion of this, the most important sample of these cocoons which has hitherto reached Europe. This large cocoon does not however consist entirely of fine silk. On cutting one open, a loose web is first met with, which, as well as the external covering, admits of being carded. Underneath this appears a kernel, as it were, of an almond shape, consisting of silk, evidently capable of being wound off. Until the present time, owing to the rarity of the cocoons in Europe, this operation has not taken place. The first attempt of the kind then laid before the meeting, would enable it to form an opinion of the quality of the threads. They are uncommonly thick and strong, but the cocoons do not seem to yield so large a proportion as do those of the *B. Pernyi* to which, in many respects, they have a great similarity. The latter, as the meeting might perceive from the samples exhibited, yield a material of very fair quality. Both kinds have, however, but an inferior gloss, not at all to be compared with the brilliant lustre which confers such value on the silk of the *B. Mori*. The dull cloth made from these cocoons, as well as from those of the *Ricinus* cocoons, has no pretensions to vie with those splendid fabrics woven from the mulberry silk. As an article of luxury in dress, the latter will always be certain to command the admiration and preference of the public. But goods will ere long be produced from *Ricinus* silk, in which the desirable quality of moderation in price will, doubtless, recommend them to the favour of economic housewives.

In order to arrive at its value in a commercial point of view, the expenses of an ordinary silk crop must be taken as a basis for the estimate. Suppose that the time of one man is required on an average to attend to the produce of each ounce of eggs. The cocoons from an ounce will, on this assumption, cost,—

1 man 45 days	12	Thalers.
8 cwt. of Mulberry leaves	8	,,
Fuel, rent of buildings, wear and and tear of utensils, &c.	1	,,
	21	

This estimate is rather above the mark than below it. By the returns from these cocoons the rearer expects not only to cover his expenses, but also to receive a surplus, which, in case he devotes his own attention to the business, may amount to about as much. The chief outlay of capital, however, is for buildings, plantations, &c., and is made with the expectation of their being required only for a few weeks in each season.

With the cultivator of the *Ricinus* silk it is far different. While the former must be content with one brood in a year, the latter can have from eight to twelve, if he will only adhere to the directions already given by the author in a previous treatise; and, granting that the expenses in each case are alike, the cultivator in the latter case is in a position to turn his capital some eight or twelve times as often, and is, of course, able to afford his article at a more reasonable rate. There will also be a comparative diminution of all outgoings, owing to there being no loss from intermission, to the management being less expensive, and to the very low value of the food. From all these circumstances, it will be apparent that the Ricinus silk must claim to be ranked among the cheapest of the textile substances; that it never can be dear will be plain from the fact that carding is found to be the most eligible mode of treating the cocoons, from which, in all cases, the moths may all be allowed to come forth, whilst the breeder looks for his profit to the quantity rather than the quality.

It is impossible at present to form a precise estimate of the saving that would accrue to Germany, supposing the cultivation of the *Ricinus* silk should ever become general, but it may fairly be assumed that the enormous sums now annually paid to America for cotton must be very considerably diminished.

Professor Dieterici, President of the Society, observes, in one of his statistical publications:—"Cotton fabrics are daily assuming more importance, and superseding, or, at least, entering into serious rivalry with, those of linen, the chief reason for which is the continually augmenting production of the raw material."

The same reason will, the author is convinced, ere long cause the *Ricinus* silk to come into general use. America, Asia, and Africa produce annually nearly four million bales (3 to 4 hundred pounds each) of cotton; and this in a continuously increasing ratio. Of this by far the largest proportion is worked up in Europe—chiefly in England—which requires a weekly supply, amounting in value to one and a half to two million dollars. Dieterici estimates the value of the cotton yarn manufactured in England and Scotland, in the year 1853, at nearly one hundred and sixty-five million dollars. In the Zollverein this manufacture is yet far from being on so extensive a scale, but it is gradually and steadily progressing, as is plain from the fact that on the average of the years 1849-1853, the importation of raw cotton had risen 136 per cent. above that of 1837; while that of foreign yarns had only increased about 35 per cent. above that of the same year.

The author then proceeding in his calculations, shows that a sum of thirty-three million thalers is annually expended within the Zollverein upon cotton manufactures; and admitting that a large portion of this must be placed to the account of labour, still half, or more, remains to that of the raw article, and he speculates on the benefit that would arise, should Germany produce the quantity of the raw article which he is sanguine enough to anticipate. Prussia would no longer be compelled to send so considerable an amount of its coin across the water—it would remain at home. A domestic production would compete with, and supersede cotton in part, with no detriment to the manufacturing interest; on the contrary, the existing cotton factories—the machinery in which might readily be adapted to suit the exigences of the new manufacture—would receive a fresh impulse, the processes being so comparatively easy, and the consumption of the fabrics being continually on the increase, and in these benefits he seems confident that the whole of western Europe would also partake. He next adverts to the enhanced value of mulberry silk, which he attributes to various causes; to the expense of renewing the mulberry plantations, to the ravages caused by the diseases prevalent during the past ten years among the worms in the silk-producing districts of Europe; to the costly manipulations of the cocoons; and also to the influence of that "absurd tyrant, fashion, who apparently, at times, takes a delight in disfiguring beauty itself, and at whose behest, the ladies, for the last few years, have been compelled to assume a double allowance both of silk and of space, and we may deem ourselves fortunate if we are enabled, by the extended production of domestic silk, to keep pace with the increasing amplitude of skirts."

The efforts made by the Great Frederick to introduce the cultivation of silk in Prussia are next adverted to. He appropriated 16,000 thalers a-year for its encouragement, and caused the requisite buildings and machinery to be erected, by the advice of his minister, Count Herzberg. Unfortunately, however, the proper steps were not taken to ensure any permanent benefit to the country from these establishments, and they were eventually discontinued. Some splendid mulberry trees alone remain (among other existing memorials of that remarkable man), but for which, the silk culture in Prussia would still be in abeyance; since upon the leaves of these trees were fed the first silkworms, which, after a long interval, were again introduced into Prussia.

The re-introduction took place in 1824, through the agency of Bolzani, the well-known virtuoso, the first brood having been reared within the precincts of the "Invaliden-Haus." Since that date, thanks to the prudent regulation of the ministry, the number of mulberry plantations, and, together with them, the produce of native silk, has been considerably on the increase—the Society for Encouraging the Growth of Silk having contributed zealously thereto. Much, however, notwithstanding the earnest exertions of Count Arnim, and the present Minister of the Interior, Herr Flottwell, still remains to be done, and the author reiterates his oft-repeated hopes, that the government will not relax in its endeavours to foster this important branch of industry, and that the further extension of mulberry plantations may be encouraged by all the means at their command.

After some further observations, more especially interesting to his own countrymen, and the members of the Society he was addressing, the author proceeds to compliment the latter, through whose means the rearing of the *Ricinus* silkworm, since its introduction by him in 1856, has been extended not only over Prussia, but also into the rest of Germany, and even into Sweden and Russia, with the most promising results. From the silk produced by these worms, he continues, were manufactured the fabrics laid before the meeting. They cannot, it is true, compete in beauty with those from mulberry silk; but he hopes, before long, to be able to submit to the Society specimens which need not shrink from meeting even this test of comparison—the requisite experiments being even now in course of operation, and the machinery brought to a state of higher perfection.

There is not the shadow of a doubt with regard to its practical value as a strong and durable material. Equally well adapted for fine, and at the same time serviceable articles of clothing, for stuffs for the use of the upholsterer, for coarse sail and tent cloths, it will speedily come into almost universal demand. And the author feels assured, on competent authority, that it will prove of great utility in the fabrication of cartridges for the artillery, and will obviate many mischances that occur at present from careless and hasty loading. But he would rather see it applied to more peaceful uses, and hopes it may one day be his lot to see the labourer following the plough in a silken smock-frock—the product of his own industry—an aspiration that will, he thinks, one day be realised; it is grounded on the easy and economical rearing of the worm and its remarkable powers of increase; a little attention during a few of the summer months to a light and easy occupation being enough to produce material sufficient to clothe a whole family for a length of time.

The author then alludes briefly to the plants on which these silkworms feed. An acre of the *Ricinus*, at its full growth, is found to be amply sufficient to feed a quarter of a million caterpillars. The quantity of leaves, which, without detriment to the plants, may be obtained from an equal space of ground planted with teasels, depends, as far as past experience enables him to judge, upon the stage of growth at which the plants have arrived. Shortly before the buds reach maturity, when the foliage is in full vigour, at least the one-half may be removed. In order to decide this point, the author intends to cause further trials to be made in various localities, how far the *Bombyx Cynthia* may be fed with success on these leaves. He announced the fact in a publication of February (last year), and distributed at the same time to his fellow members of the Society seeds of the teasel, accompanied with eggs of the insect. Further experience has tended to confirm his views in this respect, the worms exhibited to the meeting being the fifth and sixth generation fed exclusively on the leaves of the teasel. Neither cocoons, moths, nor larvæ, exhibited the slightest difference from those fed entirely on leaves of the *Ricinus*.

The objection is thus obviated, that the breeding of these silkworms in northern climates will necessitate fresh plantations annually, of a shrub which is indigenous only in the south, the *Ricinus* in Prussia seldom ripening its seeds, and not surviving through the winter months without protection. The native cultivation of the teasel yields a clear profit, varying from 25 to 100 thalers per acre (morgen). Since the plant has many large leaves and stems of great length, there is thus, in addition to the crop of heads, a large amount of vegetable matter, which may be fixed at 14 to 15 cwt. per acre, dry weight, but which at present only serves to augment the manure heap. But supposing that, over and above the acknowledged returns from the teasel crop, an additional profit may be derived from a portion that would otherwise go to waste, it will serve to give a stimulus to a branch of agricultural industry which the Prussian Government has sought to encourage for the past eight years.

After a few statistical details of the teasel culture, and the importation of the heads into the Zollverein, which he states from Dieterici to be annually on the increase, and regretting the difficulty of acclimatisation and domestication in the case of the larger animals, which prevents the objects of the Society from being better appreciated, he concludes his report by expressing a hope that he said enough to satisfy the most incredulous, and to prove the beneficial tendency of their labours, not only to their countrymen, but to the world at large.

REPORT ON RAILWAYS FOR 1858.

The report of Captain D. Galton, Royal Engineers, on the proceedings of the Board of Trade relating to railways for the year 1858, has been published as a blue-book. It adduces the following facts:—In the session of 1858, 113 Railway Bills came before Parliament, and the length of new line proposed by these bills was 698. But only 73 of the Bills were passed, and 328 miles of new line only authorized. In 1857, 82 Acts were passed, authorizing 663 miles of new line; in 1856, 59; and in 1855, 73. The amount of money authorized to be raised last year for new lines and new works was £6,834,705, against £10,336,413 in 1857, £5.784,426 in 1856, £9,192,038 in 1855, £9,211,602 in 1854, £15.517,601 in 1843, £4,333,834 in 1852, £9,553,275 in 1851, and £4,115,632 in 1850. The gross total sum authorized to be raised in the 13 years from 1846 to 1858 (both inclusive) amounted to £265,142,590. In 1846 alone, the period of the great railway mania, £132,617,368 was authorised to be raised for the construction of 4,538 miles of railway. The total amount of money authorized to be raised by railway companies by shares and on loan to the end of 1858 was £392,682,755, of which £325,375.507 had been raised, leaving £67,307,248 to be raised. There are no means of ascertaining how much of this sum appertains to the portions of railway for which the Parliamentary powers have expired. 15,659 miles constituted the total length of line authorized down to the end of 1858; but 1,610 miles have been abandoned; 9,506 miles of line were open at the end of last year, and 4,543 miles (duly authorized) remained to be opened. 6,976 were open on the 31st of December last in England, 1,342 in Scotland, and 1,188 in Ireland. The narrow gauge is quite in the ascendant, seeing that, of the 9,542 miles of line open, 6,352 miles were narrow gauge, 749 only broad gauge, 261 mixed gauge, and 1,180 "Irish" gauge. Of single lines, there were 2,088 miles of narrow, 255 of broad, 52 of mixed, and 753 of "Irish" gauge. Of 426 miles of new line opened in 1858, 372 were laid with only one line of rails. 880 miles of new line were reported to be in course of construction on the 30th of June, 1858, and of these 219 miles were opened before the last day of the year. 38,546 persons, an average of 43·79 per mile, were employed on the 30th of June, 1858, upon the lines in course of construction. The length of line open for traffic in the United Kingdom on the 30th of June, 1858, was 9,323 miles, and the number of persons employed thereon amounted to 109,329 persons, or 11·72 per mile.

£325,375.507 was the total amount raised for railways on the 31st of December, 1858, representing an expenditure of £34,243 per mile of railway open. It is assumed that on an average 6 per cent. of that expenditure has been for Parliamentary and legal expenses, 18 for land and compensation, 66 for works, and 10 for rolling stock.

It is worthy of notice that, although the cost of railways in the United Kingdom has averaged £34,243 per mile—viz., £38,779 in England, £27,532 in Scotland, and £15,061 in Ireland—the average cost of lines of railway for which Acts have been obtained since 1848, and which are now opened for traffic, has amounted to £10,500 per mile—viz., £12,600 per mile in England, £8,700 per mile in Scotland, and £6,600 per mile in Ireland. Of the total amount of money raised, £81,683,179 has been raised by loans, £61,854,547 by preference shares, and the remainder—viz., £181,837,781—by ordinary share capital.

The average rate of dividend on the whole of the ordinary share capital in railways invested was 3·06 last year against 3·60 in 1857, and 3·40 in 1856. It has always been 3 and a decimal since 1852; in that year it was 2·40; in 1851, 2·44; in 1850, 1·83; and in 1849, 1·88. The average interest on the preference capital and loan was 4·63 last year; it ranged at 4 and a decimal from 1851 to 1858; in 1850 it was 5·00, and in 1849, 4·94. The per centage of the gross receipts (less working expenses) to the total amount of capital and loan has ranged from 2·83 to 4·06. It was 3·75 last year. "It may be assumed," says Captain Galton, "that so long as the proportion of the net receipts to the capital expended increases in each year the property is in a sound condition." Last year, however, the net receipts unfortunately exhibited a decrease.

The proportion of passenger traffic to the whole traffic was 43 per cent. in England, 36 in Scotland, and 57 in Ireland. 139,193,699 persons were conveyed by railways last year, against 139,008,888 in 1857. The receipts from passengers amounted to £10,376,309, against £10,592,798 in 1857. The receipts from goods, cattle, minerals, parcels, &c., in 1858 amounted to £13,580,440, against £13,581,812 in 1857, which represents £1,458 per mile in 1858, compared with £1,524 per mile in 1857. The total receipts from goods, cattle, minerals, parcels, &c., may be divided as follows, viz.:—£7,711,350 was for the conveyance of 25.593,996 tons of merchandise, £4,046,061 was for the conveyance of 48,396,501 tons of minerals, £501,398 for the conveyance of 11,206,110 heads of live stock, and 1,321,631 for the conveyance of parcels, &c. Although there has been on the whole an increase in the receipts for goods, minerals, live stock, &c., in 1858 over 1857, the stagnation in trade caused by the panic had a perceptible effect upon the receipts of the year ended the 31st of December, 1858; in this year there was a diminution of £70,393 in the receipts on account of general merchandise as compared with the receipts of the year ended the 31st of December, 1857; this occurred entirely in England and Scotland. The traffic in live stock also showed a decrease of £22,350 in England and £1,097 in Scotland, which was reduced in the general total to £15,960 by an increase of £7,487 in Ireland. The total receipts from all sources of traffic have amounted in England and Wales to £20.244,095 or £2,939 per mile in 1858 against £20,527,748, or £3,105 per mile in 1857; in Scotland to £2,536,933 or £1,949 per mile in 1858, against £2,501,478, or £2,040 per mile in 1857; and in Ireland to £1,175,721, or £1,041 per mile in 1858 against £1,145,384, or £1,076 per mile in 1857. The aggregate receipts from all sources of traffic for the whole kingdom having been £23.956,749, or £2,572 per mile in 1858, against £24,174,610, or £2,715 per mile in 1857. Of the 140,000,000 passengers (in round numbers) conveyed last year 18,302,384 were first class, 41,693,289 second class, 79,145,464 third class and Parliamentary, and 52,562 holders of annual or season tickets. The other "live-stock" included 2,323,305 head of cattle, 6,938,160 sheep, and 2,048,619 pigs.

The general results of the traffic in 1858 exhibited by these figures are undoubtedly unsatisfactory, inasmuch as, while the length of railway in the United Kingdom has increased by above 400 miles, the receipts were actually less in 1858 than in 1857 by £217,861, and the working expenses averaged 49 per cent. of the receipts, instead of 47 per cent., as was the case in 1857. On some of the principal railway companies, however, the traffic has materially improved.

From the tables it appears that 1 passenger in 5,353.603 has been killed, and 1 in 332,204 been injured from causes beyond their own control during the year 1858. The proportion of killed and injured from similar causes to the number who travelled was 1 in 312,794.

A select committee of the House sat last year upon the subject of railway accidents, and after a careful consideration of the question they were of opinion that the responsibility of the management should be left with the railway companies, and that interference by the Government is, as a general rule, not desirable. As a contrast to the system of leaving the responsibility of management on the companies, Captain Galton has appended a translation of the regulations imposed on the companies by the Government, drawn up by a commission of inquiry into the safety of railway travelling in France, from which it will be seen how close the interference by the Government in railway management is in that country. "A careful study of these regulations appears to show that interference in the details of railway management is scarcely possible, unless the interference be carried throughout the whole system."

"There can be no doubt," he adds "that the true interests of railway companies are nearly identical with those of the public, both in respect of safety and convenience in railway travelling, and it is to be hoped that each year the railway companies will be led more and more to understand this, and, that while doing their utmost to accommodate the public, they will increase their dividends by improved management, and avoid that reckless competition by which so large an amount of money has hitherto been annually wasted."

A NEW LONG RANGE CANNON.

A wonderful long range cannon, invented by Mr. Jeffries, patentee of the well-known marine glue, is in course of being mounted in the Royal Arsenal, Woolwich, for experiments at Shoeburyness. The gun, with its present bore, namely, a three-inch diameter, weighs seven tons, and presents an appearance (with the exception of the present calibre) similar to one of our 68-pounders. The charge will consist of 16lb. of powder, and a conically-shaped shot, weighted with lead to 9lb., and hollowed similarly to the Minié bullet, which it is presumed will be propelled fifteen or twenty miles. Mr. Jeffries, it is stated, has asserted his conviction that it would carry from Dover to Calais. It is the intention of the authorities to carry out a varied and complicated course of experiments under the inspection of the Select Committee of Woolwich Arsenal. After being satisfied of its power in its present form, the bore will be progressively increased to a 68-pounder. To enable the gunners to point the gun, the trunnions will be fitted with a couple of telescopes, to assist the eye over the enormous range predicted.

NEW SHIP'S WINDLASS.

Lately, a number of gentlemen assembled by invitation on board a new ship lying in the East India Dock, and belonging to the Messrs. Green, to inspect and observe in operation a patent ship's windlass, which it is thought will produce most important results as regards the mercantile marine. The vessel herself is a valuable addition to the already noble fleet of the celebrated owners. She is named "the Newcastle," and is of 1,200 tons burden. The patent windlass exhibited on this occasion was originally an American invention, and is stated to have been applied very successfully to a number of vessels on the other side of the Atlantic; and, considerable alterations having been made in this country to improve and strengthen it, Messrs. Emmerson and Walker, the patentees of the invention in its new form, now submit it to the judgment of experience. It may be added that the Newcastle is not the only vessel which will soon afford an opportunity of working it; Messrs. Somes Brothers' new ships at Dundee and Glasgow are also being provided with it. The peculiarity of this windlass consists in its being a combination of the capstan and windlass, and in an ingenious arrangement of the parts, by which either a very heavy purchase, or a quick motion may be had at will, simply by turning the capstan round, with the sun in the one case, and in the other against it. The two ends of the windlass which take the chain can either or both be placed in connection with the capstan, and the result is that one chain only or two at one time can be worked with equal facility. The chains, it is stated, require no fleeting, but are drawn directly from the lockers, are not liable to surge, and can be paid out, checked, or stopped, at any moment, by one man at the break. The windlass is simple in its construction, and so compact that in the Newcastle it occupies only a space of seven feet six inches by four feet six inches. Combined with the windlass were seen Wardill's patent chain compressors or stoppers, by means of which one man will, it is anticipated, always be able to keep the cable under perfect control. During the visit paid to her the Newcastle's anchor was lifted, and the economy of labour was shown by the fact that 12 men, or about half the usual number of hands for an anchor of the same dimensions, were sufficient for the operation, the saving in time being far more than proportionate to that in labour. The importance of the invention in this point of view is enhanced, so far at least as the Newcastle is concerned, by the vessel's being provided with Cunningham's patent topsails—an invention which substitutes for the tedious and dangerous operation of reefing by hand a self-acting process of great simplicity and rapidity. The difficult operations of lifting and lowering the anchor, and of reefing topsails, have hitherto necessitated the employment of a much larger crew than were necessary for the ordinary duties of seamanship, and hence if these two inventions shall receive the sanction of nautical experience, they may possibly lead to a reconsideration of the number of hands which each vessel shall be compelled to have in proportion to the tonnage. Even if the legislature should consider any reduction of the number undesirable, on account of the many unforeseen emergencies of sea-life, that can be no reason for not adopting or encouraging the aids of mechanical invention, or for retaining slow and cumbrous processes in place of rapid and simple ones. As the Newcastle will shortly sail for India, the merits of the new windlass, in practice, will no doubt ere long be duly reported upon by her officers.

NEW PROCESS FOR WATERING STREETS.

An experiment is now being tried at Lyons, for laying the dust in public promenades, and it is stated to have been so far successful. A chemist of that city having accidentally spilt some hydrochloric acid on a terrace of his, found that it hardened the spot on which it had fallen, and maintained it in a state of permanent moisture. This led him to think that by watering the streets with this acid the dust on large macadamised roads might be laid, or rather prevented from rising. Experiments were first made on the Cours Napoleon, between the Rhone and the Perrache station. The success is said to have been complete, the carriage-way having now been several months free from dust; and another experiment is now being made on the Place Bellecour. During the hottest part of the day, the ground, although dry and gravelly, has the appearance of being as consistent and damp as if it had been watered half an hour before. But as evening approaches the moisture becomes more and more perceptible, and every morning the ground is stiffer, and more comfortable to walk on. This may be easily accounted for; the acid decomposing the gravel or stone, forms one or several deliquescent salts, which therefore attract the moisture of the air. The question as to whether roads thus watered are likely to last so long as they ought, can only be decided by time.

Home Correspondence.

WATER GLASS.

Sir,—The very interesting and important documents that have appeared lately in the *Journal* on the subject of water-glass (soluble silicate of potash or soda) and its application to render porous stones impermeable, together with the fact that almost all our common building stones decay rapidly on exposure to the atmosphere of large towns, render it exceedingly desirable that the buildings in France, said to have been successfully treated with the fluid silicate of potash or soda alone, should be subjected to careful examination by disinterested persons.

It would, indeed, appear that the same process has failed on that portion of the river front of the Houses of Parliament on which it was tried last year. It is, therefore, the more important that we should know whether there is such a difference in the climate of London and Paris as to account for this different result, or whether the difference, if it exists, is due to the quality and nature of the stone.

The practical results that must follow on the ultimate decision of this question are so important that either some public body, or the Government itself ought to secure an impartial report at as early a period as possible, so that the rapidly advancing decay in a large proportion of our public buildings may be checked.

I am, &c., D. T. ANSTED.

Guernsey, Aug. 22, 1859.

THE WESTMINSTER CLOCK.

Sir,—I entirely agree with the ideas put forth by your correspondent E. T. Loseby on this subject, for the following reasons:—

A great work, intended to be an example of magnitude and accuracy to the nations, should never have been submitted to a lowest tender. The unfortunate result has amply proved the great impropriety of such a course; and it is more than probable that, like the first bell, it will in the end be condemned and replaced by a second Westminster clock.

I know nothing of the designer or the maker, but this I know, that I would not have confided the construction of such a colossal piece of machinery even to the first watchmaker in the world, because the mind and hands constantly employed upon the beautiful works of pocket watches and chronometers, are ill calculated for a work of such magnitude. First-rate engine manufacturers are the parties who should have been entrusted with the execution, under the surveillance of a mixed jury of practical and scientific gentlemen. Their accuracy of workmanship and gearing would put Mr. Denison's rude and clumsy machine quite out of countenance. They would use tempered steel in the prominent parts, and the whole would be either polished or bronzed.

Your correspondent is perfectly correct in his decision that Graham's dead beat, improved or modified, would be the only escapement to be depended upon with certainty in a work of such importance, as it should be observed that all high towers are subject to a diurnal vibratory movement, depending upon the heat of the sun, which contracts the side exposed to its rays, and causes the tower to bend in that direction, to return again to its normal position in the cool of the night. In regard to the improvements suggested, I scarcely think that Mr. Loseby goes far enough, as he does not allude to the great propriety of making the clock self-winding, that is to say, that the driving weights should be suspended by the well-known double clock-line, or other suitable contrivance, so as to be continually hoisted by the power of a small steam engine, or, perhaps, still more conveniently by a water pressure engine, with, of course, the usual precautions against over or under winding, in which case no maintaining power would be required.

The difficulty of the minute hand, so much affected by stong winds, may be readily overcome, as it is only the extreme point that is required to indicate time, while all the rest might be completely protected by a disc, supported by overreaching brackets across the lines of figures, not visible from the ground.

I have had the opportunity of witnessing the construction of a large church clock, made by a common but intelligent country clockmaker, which certainly did not vary more than one second per day. But the wheels were alternately wrought iron and brass, the teeth being formed out of the solid by means of cutting and finishing engines of his own invention and make. The clock carries a two-second pendulum, and the price charged, set up and guaranteed, would be deemed fabulously small indeed in this country.

I shall be curious to see your correspondent's second letter upon the great Westminster bell, upon which I may have something to say, as bell founding and hanging is a subject with which I have some little practical acquaintance.

I am, &c.,
HENRY W. REVELEY.

WOOD WASTE.

Sir,—While passing through the lakes of Cumberland I visited some of the wood-turning establishments which are so numerous round Windermere. As the mills are worked by water-power, the waste wood cannot be consumed as fuel, as in mills where steam power is employed; I inquired what became of the refuse, and learned that is was partly carted away to the cottagers, who pay a trifling sum, hardly sufficient for the carriage, and the remainder burnt to ashes and thrown into the watercourse.

The wood used consists chiefly of well-seasoned birch, sycamore, and small ash. The quantity consumed within a few miles of Windermere lake is about fifteen thousand tons a year, four-fifths of which, or twelve thousand tons, become either sawdust or shavings.

It occurred to me that this might be turned to better account, and that perhaps it only requires publicity among your scientific readers to remedy such an enormous waste. I am, Sir, your obedient servant,

JAS. W. CARLILE.

Thickholms, near Huddersfield.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, August* 26*th*, 1859.]

Dated 13*th August*, 1859.

1871. R. Clegg, Islington, and R. Fell, St. Ann's-place, Limehouse —Apparatus for obtaining aerated fresh water from salt water.
1872. J. Stuart and W. Stuart, Musselburgh, Mid Lothian, N.B.—Imp. in nets for fishing, and for other purposes.
1873. K. Buhring, 45, Saint Paul's-road, Camden-town—An imp. in obtaining spring power, and in its application to various purposes.
1874. R. I. Watts, J. Offord, and J. R. Thomas, Plymouth—A method of condensing and consuming smoke, and other products of coals, ores, and similar substances, and reducing them to useful materials.
1875. H. T. Lambert, America-square, London—Improved apparatus to be adapted to ships' tackle or boats, for the purpose of facilitating the disengaging of ships' boats when lowered into the water. (A com.)
1876. E. Sloman, Upper East Smithfield—An improved feed water and heating apparatus. (A com.)
1877. J. R. Rostron, Edenfield, Lancashire—Imp. in locomotive furnaces.
1878. C. Mather, Salford—Imp. in machinery for stretching, drying, and finishing fabrics.

Dated 15*th August*, 1859.

1879. S. Harrison, 52, Stanhope-street, Clare-market—Broiling of chops or any other kind of meat.
1880. J. Jeyes, Northampton—An imp. in the manufacture of boots and shoes.
1881. C. Kisky, King-street, Camden Town, and W. Jones, Howland-street, Fitzroy-square—Imp. in the construction of sideboards.

1882. C. Glassborow, Girard-avenue, Philadelpha, U. S.—Imp. in pianos.

1833. J. Chanter, Bow-road, and D. Annan, Bow, Middlesex—Imp. in apparatus for supplying air to furnaces.

1884. E. Stone, 46, Lime-street—Imp. in machinery for cutting veneers. (A com.)

1885. J. Poupard, Stratford, Essex—A certain plastic combination to be used for black-leading stoves and other ironwork.

Dated August 16*th*, 1859.

1887. H. Batchelor, Newport, Monmouthshire—Imp. in steam and other motive power engines.

1889. W. Gossage, Widnes, Lancashire—Imp. in the treatment of certain offensive liquids and of noxious gases liberated from such liquids.

1890. J. C. Haddan, Bessborough Gardens, Pimlico—Imp. in wads for projectiles, and in projectiles to be used therewith.

1891. J. C. Haddan, Bessborough Gardens, Pimlico—Imp. in machinery or apparatus for rifling cannon.

Dated 17*th August*, 1859.

1893. H. Medlock, 15 and 20, Great Marlborough-street, Westminster—Imp. in Portland and Roman cement, lime, and other similar kilns or furnaces.

1895. R. A. Brooman, 166, Fleet-street—Imp. in locks and keys. (A com.)

1897. A. Yockney, Pockeredge, near Chippenham, Wiltshire—Imp. in refining and compounding oils or fatty matters with other substances for lubricating and other purposes.

Dated 18*th August*, 1859.

1899. J. Drabble, Orchard Works, Orchard-lane, Sheffield—An imp. in sewing machines.

1901. H. J. Hyams, Holywell-street, Westminster—Imp. in the construction of wet gas meters.

1903, W. Wilson, Glasgow—Imp. in the manufacture or production of bricks, tiles, and other articles of earthenware, and in the machinery or apparatus employed therein.

[*From Gazette, September* 2*nd*, 1859.]

Dated 12*th July*, 1859.

1654. T. Wright, 9, George-yard, Lombard-street—Imp. in the permanent way of railways, and in the means of preventing railway accidents thereon.

Dated 30*th July*, 1859.

1770. H. J. Newcome, Shenley, near Barnet, Hertfordshire—An apparatus for heating or warming buildings.

Dated 1*st August*, 1859.

1782. E. de Bassano, Brussels—Imp. in the manufacture of artificial fuel, commonly called patent fuel.

Dated 5*th August*, 1859.

1802. B. Tweedy, Utrecht, Netherlands—An improved mode of and apparatus for consuming smoke in locomotive and other engine furnaces, whereby coal can be used instead of coke.

Dated 6*th August*, 1859.

1812. W. R. Drake, 46, Parliament-street, Westminster—An apparatus for conducting electricity in the sea, and for telegraphing and sounding in deep water. (A com.)

Dated 9*th August*, 1859.

1848. J. Waite, Cheltenham—Imp. in making infusions for pharmaceutical purposes, which improvements are also applicable to other purposes of a similar nature.

Dated 11*th August*, 1859.

1856. W. White, 34, North Audley-street, Grosvenor-square—A four-wheeled safety sociable carriage.

Dated 16*th August*, 1859.

1888. J. H. G. Rex, Regent's Quadrant—Imp. in the construction of dwelling-houses or other buildings, for the purpose of facilitating the escape of the inmates in case of fire.

Dated 17*th August*, 1859.

1892. J. Sidebottom, Waterside, Derbyshire—Certain imp. in power looms for weaving.

1896. S. Beardmore, 27, Albion-street, Hyde-park—Imp. in electric batteries.

Dated 18*th August*, 1859.

1898. W. Grimshaw, Lower Broughton, near Manchester, and S. Mason, jun., Manchester—Imp. in machinery and apparatus employed in washing, bowking, bleaching, and preparing flax, and other substances.

1900. A. J. Canu, Paris—Imp. in machines for breaking or crushing stones, minerals, or other similar materials.

Dated 19*th August*, 1859.

1904. P. Salmon, Glasgow—Imp. in locomotives, and in apparatus for warming trains of carriages connected thereto.

1905. W. T. Henley, St. John-street-road, Clerkenwell—Imp. in machinery for the manufacture of ropes and cables, and for paying out and picking up submarine telegraph cables.

1906. S. Boult, Liverpool—Imp. in the means of, or apparatus for retarding railway carriages.

1907. J. Jackson and J. Thorley, Worsley, Lancashire—Imp. in hoists for raising and lowering weights.

1908. J. Fowler, jun., R. Burton, and D. Greig, jun., Cornhill, E. E. Allen, Park Side, Knightsbridge, and W. Worby, Ipswich—Imp. in ploughs, cultivators, or tilling inplements, and in machinery for giving motion to the same by steam power.

1909. H. W. Harman, Manchester—Imp. in steam boilers, and in working the same, and in safety valves, and apparatus connected therewith.

Dated 22*nd August*, 1859.

1911. E. Hardon, Stockport—Certain imp. in looms for weaving.

1912. W. Finegan, Belfast—Imp. in apparatus for lubricating machinery.

1913. D. Grant, Edinburgh—Imp. in wet gas meters.

1914. G. W. Petter and T. D. Galpin, Belle Sauvage-yard, Ludgate-hill—Imp. in printing presses.

1915. W. A. Vérel, Macduff, Banff—Imp. in the preparation of bones for manure.

1916. R. A. Brooman, 166, Fleet street—Imp. in apparatus for preparing and spinning fibrous materials. (A com.)

1917. J. J. O. Taylor, Mark Lane—An imp. in the separation of silex and silicious matter from iron.

1918. Captain H. Spratt, R.M., Plymouth—Imp. in revolving pistols and other fire-arms.

1919. Hon. W. Talbot, Army and Navy Club, Pall Mall—An improved cigar lighter.

1920. H. Parkes, Birmingham—Imp. in the manufacture of cylinders, and tubular or hollow bodies of copper, and alloys of copper or other ductile metals.

1921. E. Abbott, Brunswick-square, Middlesex—Imp. in ordnance and fire-arms.

1922. O. Maggs, Bourton, Dorset—Imp. in taps, cocks, or valves.

1923. R. S. Harvey, Lincoln—Imp. in apparatus for dusting vines, hops, and other plants and trees with sulphur, and other powder.

Dated 23*rd August*, 1859.

1925. P. F. C. de la Salle, Nice, Italy—A new method of arranging the keys on the fingerboards of pianos, organs, and other similar instruments.

1927. T. Fry, Liverpool—The application of enamelled slate to the new purpose of lining, panelling, or otherwise facing the internal or external walls of houses, public buildings, and edifices generally.

1929. O. Maggs, Bourton, Dorset—Imp. in apparatus for weaving straw, rushes, and other materials into fabrics.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, September* 2*nd*, 1859.]

August 31*st*.

441. S. T. Cooper.
546. J. T. Carter.
553. J. W. Harker and J. K. Field.
554. E. Roche.
560. H. Brown.
566. J. D. Dougall.
573. C. F. Dennet.
576. R. A. Brooman.
579. J. M. Dunlop.
582. F. W. Parker.
588. R. Leake and M. Sykes.
592. W. Palmer.
594. W. Gossage.
595. J. Aspinall.
599. J. L. Jullion and G. Pirie.
601. A. Booth, sen., and A. Booth, jun.
603. G. Twigg.
610. J. A. Williams.
612. J. R. Nicholson.
626. R. Hellard.
645. C. H. Hurst.
654. W. Clark.
657. W. Robertson and J. G. Orchar.
706. W. C. Cambridge.
709. W. Hudson and C. Catlow.
721. W. A. Gilbee.
754. H. Rigby.
780. W. Mossman.
800. A. V. Newton.
818. W. E. Newton.
830. A. Paget.
935. J. Luis.
993. J. Wotton.
1060. J. Holroyd.
1410. F. Puls.
1420. F. A. T. De Beauregard.
1497. R. Smith.
1521. R. Hornsby.
1561. L. L. Tower.
1598. J. H. Nalder and T. Nalder.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September* 2*nd*, 1859.]

August 29*th*.

2016. J. Blake and F. Maxwell.
2037. J. Apperly.
2047. E. P. Spiller.

August 31*st*.

2038. P. J. Guyet.

[*From Gazette, September* 6, 1859.]

September 1*st*.

2068. W. S. Mitchell and C. M. E. Gartner.
2076. S. W. Park & E. S. Ellis.

September 2*nd*.

2054. E. Leigh and G. P. Leigh.
2070. R. Wilson.

September 3*rd*.

2062. B. O. Stratford, Earl of Aldborough.
2064. J. B. Dancer.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4195	Aug. 19	Candlestick	Joseph Caddick	Birmingham.
4196	,, 23	A Shoe or Boot Maker's Last Stand	William Keates	High-street, Cheadle, Staffordshire.
4197	,, 24	A Fastening for Pocket Books, Purses, Portmonnaies, and other similar articles..	Thomas De la Rue and Co. ...	Bunhill row, E.C.
4198	,, 27	Cartridge Case Drawer, for Breech-loading Fire Arms........................	Henry Elliott	Birmingham.
4199	,, 30	The Colonial Belted Trowsers	Fenwick Brothers	71 and 72 High-street, Gravesend.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 16, 1859.

◆

ON THE RELATIVE POWER OF METALS AND ALLOYS TO CONDUCT HEAT.

By F. Crace Calvert, F.R.S., and Richard Johnson, F.C.S.

The following paper was communicated to the Royal Society, and has been published in the *Philosophical Transactions* :—

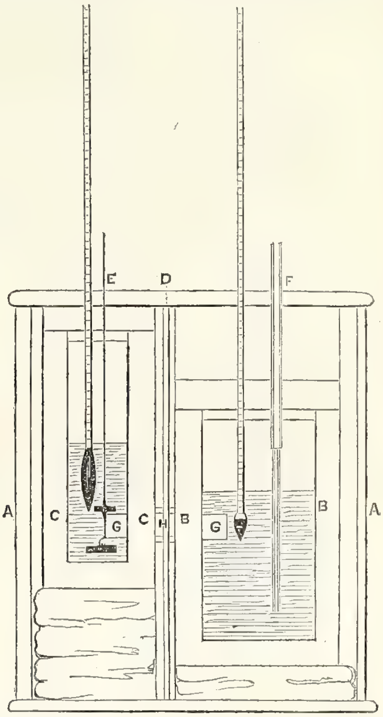
Metals and their alloys being now so extensively employed in arts and manufactures and for instruments of precision, we have thought that it would be interesting, in a scientific or commercial point of view, if we were to examine their conductibility carefully and completely.

To enable us to determine with accuracy the conducting power of all the ordinary metals, and of seventy of their alloys and thirty of their amalgams, we had to find out a new method of determining the conducting power of metals; for the process followed by M. Despretz could only give results to be relied upon for a few of the best conductors, such as silver, gold, and copper. Further, his process, which consists in having a long and thick bar of metal, so as to allow holes to be drilled, in which mercury and the bulb of a thermometer are inserted, would have required a large quantity of each metal in a state of purity, the labour of obtaining which, even comparatively pure, is well-known. Also from the fact of mercury being employed, we should have been unable to ascertain the conducting power of such important alloys as brass and bronzes, and could not have applied the process to amalgams.

The method which we have followed gives such consistent results, that we have not only been able to determine the influence exercised on the conducting power of metals by the addition of 1 or 2 per cent. of another metal, but also to appreciate the difference of conductibility of two alloys made of the same metals, and only differing by a few per cent. in the relative proportions of the metals composing them. At the same time the conditions theoretically required in order to obtain results independent of everything but the nature of the substances, are not very rigorously fulfilled, so that the term conducting power, as used by us, must be understood in a somewhat qualified sense, and as having relation to our method of determining it. We believe, however, that the ratios of the conducting powers, as determined by our method, do not differ from those of the real conducting powers.

Before describing the process followed and examining the results obtained, it is necessary to state that we have made a great number of experiments with the hope of solving the important chemical question, are alloys simple mixtures of metals, or are they definite compounds? With this view we have operated on a large number of alloys and amalgams, convinced that if the chemical nature of alloys and amalgams is still enveloped in darkness, it is because they have been prepared with impure or commercial metals, and not made in equivalent quantities. The consequence has been, that as metals have only a slight affinity to each other, and as the definite compounds which they have a tendency to form were mixed with an excess of one of the metals employed, the alloys produced have presented properties which could lead to no information as to their nature. These difficulties have been increased by the fact, that in many alloys, such as those of copper and tin, or copper and zinc, the metals have a tendency, when allowed to cool slowly, to form several crystallizable compounds, differing in their composition in the various parts of alloys; the less fusible being on the exterior, and those more so in the interior of the mass. The impurities existing in commercial metals are often so large as considerably to modify the properties of their alloys; for we have found in our researches that if 1 per cent. of a metal be added to 99 of another, it alters its conducting power most materially. To avoid these causes of error, we have composed our alloys of pure metals and employed definite proportions.

The apparatus which we used is composed of a deal box, A (see woodcut), 105 millims. in width, 165 millims. in length, and 220 millims. in height; with a cover, and painted white externally and internally. Inside this box are two vulcanized india-rubber square vessels, the sides of which are 15 millims. thick. The larger vessel, B, measures internally 52 millims. on the side and 125 millims. deep, and is capable of containing 336 cub. cent. of water. The smaller vessel, C, is 27 millims. on the side and 125 millims. deep, and has a capacity of 90 cub. cent.



These vessels are painted white and surrounded with wadding; and still further, to prevent any radiation of heat, a deal board, D, is placed between the two vessels. So little heat is radiated from the vessel B, when it contains 200 cub. cent. of water at 90°, to the smaller vessel, C, containing 50 cub. cent. at 16°, that in a quarter of an hour, the time required for our experiments, the water in the latter vessel did not rise one-tenth of a degree Centigrade. Therefore all sensible radiation and conduction was avoided, and the rise of temperature in this vessel, during the experiment, must have been entirely due to the heat conducted by the square bar of metal (G) used. This bar is 6 centims. long and 1 centim. square, and is so arranged in the experiment, that 1 cub. cent. is in the vessel, B, 1 cub. cent. in the vessel C; 3 cub. cent. are covered by the sides of the boxes, through which it passes; and the last 1 cub. cent., is covered with a piece of vulcanized india-rubber tubing, and the whole made secure from any leakage by lining the sides of the holes, through which the bar passes, with a varnish made of caoutchouc dissolved in benzine. The bar is placed 54 millims. from the bottom of D, and 12 millims. from the bottom of C.

When we desire to make an experiment, the vessels are put in water so as to equalise their temperature; they are then carefully wiped and placed in the wooden box, surrounded with wadding, and 50 cub. cent. of water, at the temperature of the room, poured into the vessel C; the two boxes are then covered with vulcanized india-rubber lids, each perforated with two holes; the vessels are covered with wadding, and the lid of the box shut. Through one of the holes in the vessel C is introduced a very sensitive thermometer, graduated in tenths of a degree; in the other hole is a small whalebone rod, B, having at its extremity a piece of vulcanized rubber to agitate thoroughly the water in the vessel during the experiment, and render it of a uniform temperature. When the water in the vessel C has attained a fixed temperature (which is generally within one degree of that of the room), a thermometer is introduced into the vessel B, and 200 cub. cent of boiling water poured in by means of a funnel, which communicates with a tube F; the temperature of the liquid falls to 86° or 88°, but is again raised within three minutes to 90°, by a small jet of steam, generated in a flask, the water in which is kept boiling during the whole of the experiment. A few experiments soon enable the operator to keep up a constant temperature of 90° in the vessel B during the quarter of an hour which the experiment requires. Immediately on the boiling water being poured into the vessel B, the operator looks attentively at the scale of the thermometer in vessel C, and as soon as he perceives the column of mercury rising, he carefully marks the second and minute dials of his watch, and makes similar marks fifteen minutes further on. During this time the operator agitates the liquid in vessel C with the agitator E, and every five minutes marks down the rise of temperature. The water in the vessel B has a uniform temperature, owing to the agitation produced in it by the small jet of steam which arrives almost close to the bottom.

The following figures will show how insignificant was the radiation from the larger vessel B, containing 200 cub. cent. of water at 90° C., to the smaller vessel C, containing 50 cub. cent. of water at natural temperature, when the two vessels were not connected by a metallic bar, though placed in their usual position in the apparatus, for in fifteen minutes the temperature of the water in the smaller vessel C only increased 0·05 of a degree, and in half an hour only 0°·7.

	Temperature of the water in the vessel C.
	Degrees.
	17·20
After 15 minutes	17·25
After 30 minutes	17·90

Therefore the entire increase of temperature in the vessel C, in our experiment, must have been due to the heat conducted by the bar.

It was found that it required twenty-four hours before the temperature of the water in the vessels of the apparatus was in equilibrium with that of the surrounding atmosphere, when 200 cub. cent. of boiling water was poured into the vessel B, and the apparatus left to cool. It might be objected that in our experiments we neglected to take into account the heat absorbed by the sides of the vessel C; but we found, from a great number of experiments, that whether we took into consideration, or not, the amount of heat absorbed, it did not affect in any degree the relative conductibility of the metals and their alloys; but it must be borne in mind that it was not the absolute quantity of heat communicated to the bar in vessel B which was determined in vessel C, but the relative facility of conduction by various metals, all circumstances being the same. The best proofs that we can give of the accuracy of the process are—1st, that the series of alloys which conduct heat in the ratio of the equivalents of the metals composing them would not have shown such a coincidence between the observed and theoretical results if our process had presented any serious defects; 2nd, that we have been able to determine with accuracy the marked influence exercised by the addition of 1 per cent. of a metal to another metal; 3rd, it will be seen further on in the paper, that we have determined with precision, that in copper bars, having different conducting surfaces, the observed result agrees with the calculated one.

The process followed to ascertain the amount of heat absorbed by the vessel C, consisted in putting into the vessel, cooled down to the natural temperature, 50 cub. cent. of water, having the temperature which the water had when the last experiment was completed, and noticing how much heat was absorbed from the water during the quarter hour. For example:—

	Mean conductibility.	Mean absorption.	Total.
Zinc cast vertically ...	20·03 ...	8·80 ...	28·83
Antimony cast vertically	6·12 ...	2·50 ...	8.62

but as 20·03 : 6·12 : : 28·83 : $x = 8{\cdot}80$, the relative conducting power of antimony.

Therefore it is quite clear that the addition of the heat absorbed by the vessel C, to the heat of the water in the same, would have complicated our results without any advantage.

We shall only give two examples here to show how very regularly the apparatus works, and how accurately it indicates the different degrees of conducting power of two metals. The increase of temperature, in the successive five minutes, is in the same ratio whether the conductors be good or bad.

Names of the metals.	Temperature of the room.	Temperature of the 50 cub. cent. of water before beginning.	Temperature of the 50 cub. cent. of water after each 5 minutes.			Constant temperature of the 200 cub. cent. of water.	Conductibility found.	Mean.
	Deg.	Deg.	Deg.	Deg.	Deg.	Deg.		
Pure Copper	20	21	34·4	42·7	48·0	90	27·0	27·05
	20	20	33·6	41·8	47·1	90	27·1	
Lead	18	18·2	22 0	25·1	27·4	90	9·2	9·17
	18	18·3	22·1	25·0	27·45	90	9·15	

In fact, it is owing to the facility of appreciating within two-tenths of a degree, in two successive essays, the conducting power of a metal or alloy, that we have been able to determine the precise conducting power of so large a number of alloys and amalgams, and even these researches have required more than a year's constant labour and attention.

The metals which we used were purified by the following processes:—

GOLD.—About 140 grammes of nearly pure gold were dissolved in aqua regia, and the liquid evaporated to dryness. The residue was dissolved and filtered, and to the filtrate a solution of protosulphate of iron was added. The gold thus precipitated was washed with hydrochloric acid, and fused with a little borax and nitre.

SILVER.—Pure chloride was reduced by fusing with pure carbonate of potash.

Copper was obtained by reducing pure oxide of copper by a current of pure hydrogen, or by depositing it from a solution of pure salt at a pole of a galvanic battery.

TIN.—Well-crystallised protochloride of tin was recrystallised, and when quite pure, was reduced by being fused with a mixture of bicarbonate of soda and lamp-black.

BISMUTH.—Pulverised bismuth was dissolved in strong nitric acid, the liquor filtered through asbestos, and mixed with twenty times its bulk of water. The subnitrate thus obtained was washed, dried, and reduced with lamp-black.

ANTIMONY.—This metal was pulverised and fused with a mixture of pure nitrate and carbonate of soda; the antimoniate of soda so produced was washed with boiling water until the filtrate was no longer alkaline. The insoluble mass was dried and reduced with lamp-black.

LEAD.—Nitrate of lead was re-crystallised, and, when pure, the salt was dried and calcined. The oxide of lead so prepared was reduced by lamp-black.

ZINC.—Vieille Montagne zinc was redistilled twice.

CADMIUM.—The metal was obtained pure by dissolving in hydrochloric acid, and passing sulphuretted hydrogen into the liquor. The sulphuret of cadmium was well washed with a solution of sulphuretted hydrogen and dissolved in hydrochloric acid; carbonate of ammonia was added, and the precipitate was washed, dried, mixed with lamp-black, and the cadmium distilled.

The platinum, aluminium, iron, and sodium which we used were only commercially pure.

As the determination of the power of metals to conduct is of great importance, we shall give here a detailed record of the results obtained:—

NAMES OF THE METALS.	Temperature of the 50 cubic cent. of water before beginning.	Temperature of the 50 cub. cent. after 15 minutes.	Conductibility found.	Mean.	Conductibility, Silver = 1,000.
	Degrees.	Degrees.			
Silver $\frac{1000}{1000}$	19·8 19·7	51·6 51·7	31·8 32·0	31·9	1000
Gold $\frac{1000}{1000}$	14 13·6	46·4 44·8	31·40 31·20	31·30	981
Gold $\frac{991}{1000}$	20·3 20·3 20·0	47·3 47·0 46·7	27·0 26·7 26·7	26·80	810
Copper (rolled)	19·5 20·0 21·0 20·5	46·3 47·1 48·0 47·45	26·8 27·1 27·0 26·95	26·95	845
Copper (cast)	21·30 21·45	47·2 47·3	25·90 25·83	25·87	811
Mercury	15·0 16·6	36·7 38·1	21·7 21·5	21·60	677
Aluminium	18·2 17·7	39·3 39·0	21·1 21·3	21·20	665
Zinc (rolled)	18·4 19·9 18·5	39·0 40·2 38·9	20·6 20·3 20·4	20·45	641
Zinc (cast vertically)	19·6 19·2 14·0	39·8 39·1 35·0	20·2 19·9 20·0	20·03	628
Zinc (cast horizontally)	20·6 20·8	40·0 40·2	19·4 19·4	19·40	608
Cadmium	18·0 16·5	36·5 34·8	18·5 18·3	18·40	577
Malleable iron	18·70 19·05	32·6 33·0	13·9 13·90	13·92	436
Tin	20·5 21·2	34·0 34·6	13·55 13·4	13·45	422
Steel	15·2 15·5	27·8 28·2	12·6 12·7	12·65	397
Platinum	15 14	27·1 25·2	12·1 12·2	12·15	380
Sodium	14·2 14·1	25·9 25·7	11·7 11·6	11·65	365
Cast iron	14·9 15·6	26·4 27·0	11·50 11·40	11·45	359
Lead	20·5 18·3	29·70 27·45	9·20 9·15	9·17	287
Antimony (cast horizontally)	14·6 14·3	21·5 21·1	6·9 6·8	6·85	215
Antimony (cast vertically)	19·2 18·9	25·30 25·05	6·10 6·15	6·12	192
Bismuth	19·0 18·3	21·00 20·20	2·00 1·90	1·95	61

From the details given in describing the apparatus used in our experiments and the methods followed, it will be easy to perceive that for the solid metals we always employed square bars, 1 c. m. square and 6 c. m. long. These bars were always cast of a larger size than required, and were filed down to the exact dimensions. For mercury and sodium we were obliged to have recourse to other methods of operating. We employed a very thin sheet-iron box, the internal dimensions of which were exactly those of the square metallic bars which we usually employed. To admit the mercury, there was in the middle of one of the longitudinal surfaces a small hole, 4 millims. in diameter, and when full of mercury the hole was stopped by a little thick caoutchouc varnish. The box was then weighed, by which it was easy to ascertain if it was quite full. It was then introduced into the two vulcanized india-rubber boxes, and the conducting power of the mercury and box determined. By subtracting the special conducting power of the box (which had previously been ascertained) from the total conducting power of the box and mercury, the difference was the conducting power of the mercury as given above. We operated in the same way with sodium, with this difference, that we melted the sodium under benzine, and whilst fluid filled the box with it. Of course we cannot pretend that the figures which we give in these two instances represent their exact conducting power, but they are at all events very near the truth. We endeavoured to ascertain the conducting power of potassium in the same way, but failed, owing to the tendency which potassium has to granulate when melted under benzine.

We think it our duty to state that we are aware of the respective works of M. Langberg and of MM. Wiedemann and Franz, but that we have not followed their thermo-electrical process, as we deemed our method capable of giving more direct and reliable results. We have, however, great pleasure in confirming their results with reference to the superior conducting power of silver to that of gold, though the order of conductibility of the other metals as determined by our process is different from theirs.

In determining the conducting power of metals great attention must be paid to their physical state, as their conductibility is modified by their molecular condition.

INFLUENCE OF MOLECULAR CONDITION.

We found that the conducting power of several metals was different when they were rolled out into bars, or when cast. Thus, for example,—

	Conductibility found.	Conductibility. Silver = 1,000
Rolled copper......	26·95	845
Cast Copper	25·87	811

It is probable that the reason why rolled metal conducts heat better than the same metal when simply cast, is that the molecules composing the rolled metal are in closer contact than those composing the cast metal, owing to the process of rolling; and it is worthy of observation that this view agrees with Mr. J. P. Joule's theory, that heat travels in bodies by the vibration of matter, and not by the fluid called caloric, travelling between the interstices of the molecules.

INFLUENCE OF CRYSTALLISATION.

The influence of the molecular arrangement is clearly illustrated in the following examples, where it is seen that the conducting power of zinc, antimony, and bismuth is modified according to the axes of crystallisation. Thus the conducting power of zinc is different if the sample for experiment is cast horizontally or vertically; for example,—

	Conductibility found.	Conductibility. Silver = 1,000
Zinc cast vertically......	20·03	628
Zinc cast horizontally...	19·40	608

If these two square bars be broken and examined, they present a very great difference.

The one cast vertically has four axes of crystallisation all starting from the centre and proceeding towards each angle of the bar. The one cast horizontally has one centre line or axis of crystallisation, which divides the square bar into three parts.

The results obtained with antimony are the following:

	Conductibility found.	Conductibility. Silver = 1,000.
Antimony cast vertically ...	6·12	192
Antimony cast horizontally	6·85	215

We shall refer to the extraordinary influence exercised by crystallisation on conduction of heat when we examine some of the alloys.

Influence of small amounts of Impurities on the Conducting Power of Metals.

We have thought that it would be useful to ascertain the influence which one per cent. of a metal exercises when added to another, and these are the curious results obtained with gold and silver:—

	Found.	Conductibility. Silver = 1,000.
Pure gold	31·31	981
Gold with 1 per cent. of silver	26·80	840

Therefore the addition of 1 per cent. of silver, the best conductor, to gold, diminishes its conducting power nearly 20 per cent.

We have observed much more marked examples of the diminution of conductibility of a metal by the addition of 1 per cent. of another metal, for example, whilst the conducting power of pure mercury is 21·60, it is only 13·15 when amalgamated with 1·25 per cent. of tin. Professor W. Thomson having lately discovered that a small quantity of various metals added to copper greatly modifies the conduction of electricity by this metal, we deemed it advisable to try if the conduction of heat by copper would also be altered if we were to alloy it with 1 per cent. of various other metals. We were fortunate enough to obtain results which coincide with his, namely, that some metals increase the conduction of heat by copper, whilst others diminish it.

We have also examined the influence which carbon exercises on the conductibility of iron, and we hope that the results observed will prove useful in a commercial point of view; for as seen by the figures obtained, the difference is about equal to 18 per cent. The following are the results:—

	Found.	Conductibility. Silver = 1,000.
Malleable Iron*........................	13·92	436
Steel......................................	12·65	397
Cast iron................................	11·45	359

We also thought that it would be interesting to ascertain what would be the influence of another non-metallic substance on a metal, and we accordingly made the following series:—

	Found.	Mean.	Conductibility. Silver=1,000.
Cast copper	......	25·87	811
Copper with 1 per cent. of arsenic ...	18·1 18·3	18·20	570
Copper with 0·5 per cent. of arsenic	21·3 21·4	21·35	669
Copper with 0·25 per cent. of arsenic	24·7 24·5	24·60	771

These results confirm the influence of a non-metallic body on the conductibility of a metal. It is interesting to observe that the influence of arsenic on the conduction of heat on copper is in ratio with the increased quantity of arsenic.

We have also examined a great number of alloys with the hope of throwing some light on their chemical composition, and we trust that the facts which we are about to describe will not only tend to illustrate this point, but will also be of interest from the new and various results observed.

We have also made a great variety of experiments with the view of ascertaining if there be a general law in connexion with the conduction of heat by alloys, and although we could not trace any general rule, still we observed several useful facts.

The conduction of heat by alloys may be considered under three general heads:—

1. Alloys which conduct heat in ratio with the relative equivalents of the metals composing them.

2. Alloys in which there is an excess of equivalents of the worse conducting metal over the number of equivalents of the better conductor, such as alloys composed of 1Cu and 2Sn; 1Cu and 3Sn; 1Cu and 4Sn, &c., and which present the curious and unexpected rule that they conduct heat as if they did not contain a particle of the better conductor; the conducting power of such alloys being the same as if the square bar which we were examining was entirely composed of the worst conducting metal. A not less remarkable fact is that the alloys of a series such as those of 2 equivalents of bismuth and 1 of lead, 3Bi and 1 Pb, 4Bi and 1Pb, 5Bi and 1Pb, all conduct the same, viz., about 1·9, the various increasing quantities of lead exercising no influence on the conductibility of the alloys. The results obtained with this class of alloys are most important to engineers; for it will be seen in the case of the alloys of brass and bronze, that no increase is gained in the conductibility of an alloy by increasing the quantity of a good conductor; nay, in many cases it would be a decided loss, unless a sufficient quantity of the better conducting metal be employed to bring the alloy under the third head.

3. Alloys composed of the same metals as the last class, but in which the number of equivalents of the better conducting metal is greater than the number of equivalents of the worse conductor; for example, alloys composed of 1Sn 2Cu; 1Sn 3Cu; 1Sn 4Cu: in this case each alloy has its own arbitrary conducting power; the conductibility of such an alloy gradually increases and tends towards the conducting power of the better conductor of the two metals composing the alloy.

Before describing the experiments which relate to these three classes of alloys, we deem it advisable to state, that from the numerous assays which we have made, we are led to believe that the conduction of heat by alloys is greatly modified by the crystalline system to which each of the metals composing them belongs, or by the peculiar crystalline form of its own crystals; for we have observed that some of the crystallized alloys of copper and tin, and copper and zinc, have a special conducting power of their own; for example—

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Tin, 1 equivalent......... 38·21 Copper, 3 equivalents... 61·79 100·00	15·75	21·37	494	670
Tin, 1 equivalent .... 31·73 Copper, 4 equivalents... 68·27 100·00	4·96	21·88	155	686

Whilst the alloys which present little or no crystalli-

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* The iron was manufactured from the same cast iron as that used in this experiment, and both were identical to those used by Mr. Joule in his thermo-electrical experiments. Their composition was as follows:—

	Analysis of Cast Iron.	Wrought Iron.
Carbon..............................	2·275	0·296
Silicium	2·720	0·120
Phosphorus.........................	0·645	0·139
Sulphur	0·301	0·134
Manganese and aluminium ...	traces	
Iron..................................	94·059	99·311
	100·000	100·000

zation have a conductivity which is in ratio to the equivalent quantities of the metals composing them; for example—

	Found.	Calculated.	Silver = 1,000	
			Found.	Calculated.
Lead, 1 equivalent ...... 36·99 Tin, 3 equivalents ...... 63·01 100·00	11·96	11·86	375	372
Lead, 1 equivalent ...... 30·56 Tin, 4 equivalents ...... 69·44 100·00	12·17	12·14	381	381

The method which we have followed to calculate the theoretical conducting power of our alloys is the following:—

Multiply the per-centage quantity of each metal by the respective conducting power of that metal, add the results together and divide by 100; for example, in the alloy Pb 3Sn,

Pb 36·99 × 9·17 = 339·19
3Sn 63·01 × 13·45 847·48
100)1186·67
11·86 the theoretical conducting power of the alloy.

We have also taken care always to cool the alloys rapidly, so as to render their mass of a more uniform composition, and prevent, especially in copper and tin alloys, the formation of various crystalline compounds having different compositions.

The first class of alloys which we shall describe, are those which conduct heat in the ratio of the conductibility of the metals composing them. This class is represented by the alloys of tin and lead, and tin and zinc.

TIN AND LEAD.

Formula of the alloys and Per-centage.	Found (Mean).	Calculated.	Silver = 1,000.	
			Found.	Calculated.
5Sn = 73·97 1Pb = 26·03	12·28	12·30	385	386
4Sn = 69·44 1Pb = 30·56	12·17	12·14	381	381
3Sn = 63·01 1Pb = 36·99	11·96	11·86	375	372
2Sn = 53·18 1Pb = 46·82	11·16	11·16	350	350
1Sn = 36·22 1Pb = 63·78	10·52	10·72	230	236
1Sn = 22·11 2Pb = 77·89	10·00	10·11	313	317
1Sn = 15·91 3Pb = 84·09	9·91	9·85	311	309
1Sn = 12·44 4Pb = 87·56	9·60	9·69	301	304
1Sn = 10·20 5Pb = 89·80	9·55	9·60	299	301

TIN AND ZINC.

Formula of the alloys, and per-centage.	Temperature of the 50 cub. cent. before beginning.	Temperature of the 50 cub. cent. after 15 minutes, from 5 to 5 minutes.			Conductibility found.	Mean.	Calculated.	Silver = 1,000.	
	DEG.	DEG.	DEG.	DEG.				Found.	Calculated
5Zn = 73·43 1Sn = 26·57	17·0 17·0	24·9 24·7	30·3 30·2	34·2 34·3	17·2 17·3	17·25	18·25	541	572
4Zn = 68·86 1Sn = 31·14	16·4 16·0	24·3 24·1	30·5 30·0	34·7 34·3	18·3 18·3	18·3	17·99	574	564
3Zn = 62·43 1Sn = 37·57	17·6 16·7	25·3 24·5	30·5 29·9	34·4 33·7	16·8 17·0	16·9	17·57	530	551
2Zn = 53·11 1Sn = 46·89	18·5 17·5	26·4 24·9	31·5 30·3	35·2 34·1	16·7 16·6	16·65	16·95	522	532
1Zn = 35·61 1Sn = 64·39	18·1 17·4	25·5 24·6	30·5 29·8	34·1 33·4	16·0 16·0	16·00	15·80	501	495
1Zn = 21·65 2Sn = 78·35	17·1 16·6	23·8 23·3	28·7 28·2	32·3 21·7	15·2 15·1	15·15	14·90	475	467
1Zn = 15·55 3Sn = 84·45	17·5 17·6	24·3 24·4	28·9 28·9	32·2 32·1	14·7 14·5	14·6	14·39	458	451
1Zn = 12·14 4Sn = 87·86	17·3 17·5	23·8 23·8	28·7 28·8	32·0 32·0	14·7 14·5	14·6	14·25	457	447
1Zn = 9·95 5Sn = 90·05	17·1 17·0	23·6 23·4	28·4 28·2	31·7 31·5	14·6 14·5	14·55	14·10	456	442

The above two series of alloys are the only ones which conducted heat, as above stated; and from experiments which will be described further on, we believe that the metals composing these alloys are simply mixed, and not combined together.

(*To be continued.*)

NEW HORTICULTURAL GARDEN AT KENSINGTON GORE.

A model, showing how the ground will be laid out in terraces, for the garden of the Horticultural Society, has just been placed in the South Kensington Museum, at the north end, near the entrance to the ornamental art rooms. Between the Kensington-road and Cromwell-road, the ground falls about 40 feet, and using this fact in aid of a general effect, the ground has been divided into three principal levels. The entrances to the gardens will be on the lower level, in Exhibition and Prince Albert-roads, and the central pathway, upwards of 75 feet wide, ascending through terraces to the third great level, will lead to the Winter garden. The whole garden will be surrounded by Italian arcades, each of the three levels having arcades of a different character. The upper or north arcade, where the boundary is semi-circular in form, will be a modification of the arcades of the Villa Albani, at Rome. The central arcade will be almost wholly of Milanese brickwork, interspersed with Terra Cotta, Majolica, &c., whilst the design for the south arcade has been adapted from the beautiful cloisters of St. John's Lateran, at Rome. None of these arcades will be less than 20 feet wide and 25 feet high, and they will give a promenade, sheltered from all weathers, more than three-quarters of a mile in length. The arcades and earthworks will be executed by the Commissioners for the Exhibition of 1851, at a cost of £50,000, whilst the laying out of the gardens and construction of the conservatory, or Winter garden, will be executed by the Horticultural Society, and will cost about the same sum, the greater part of which has been already raised.

THE SALT TRADE.

The Report presented to the Annual Meeting of the Salt Chamber of Commerce,* held on the 5th August, has just been issued.

The Report says that the two leading questions in connexion with the amelioration of the trade, are the facility of being allowed to import salt into China, and to extend the trade already in operation with India. As regards the former, a deputation from the chamber had an interview with Lord Elgin, when his Lordship stated that, up to the time of his negociating the Chinese treaty, no allusion whatever had been made to the subject of a salt import, nor had Sir John Bowring brought it under his notice. The Chinese were so very poor that any interference with their revenue was a difficulty; but if arrangements could be made with the Chinese Government, or it could be shown that they would be benefited by the admission of English salt, other difficulties might be removed. They were much afraid of smuggling, but it was pointed out to Lord Elgin that the bulky nature of salt placed it on a very different footing to opium, which was now legally admitted into China.

The deputation pointed out to his lordship the success which had attended the import of salt into Calcutta, and the large revenue it yielded to the Indian Government, and he expressed his willingness to further the views of the Chamber in obtaining the admission of British salt into China, and that he would be glad to receive any commmunication on the subject, as also to write to his brother, Mr. Bruce, thereon.

Upon the favourable information thus afforded, the Chamber proceeded to prosecute measures for obtaining the support of Her Majesty's Government, and presented the following memorial—to Lord John Russell, as Secretary of State for Foreign Affairs:—

"The Memorial of the Salt Chamber of Commerce respectfully sheweth, that during the past year representations were made to the Foreign Office as to the great advantages that would result from opening up a trade in British salt with the vast Empire of China, both to the salt manufacturers and to British shipowners, who are always greatly at a loss for bulky articles wherewith to assist in loading their ships to that country.

"That, unfortunately, the new treaty with China had been concluded before the attention of his Excellency Lord Elgin was called to the subject, otherwise your memorialists are assured the admission of salt might have been stipulated for in that treaty on some equitable principle, calculated to protect the Chinese Revenue, which is supposed to be largely dependent on the article of salt.

"That previous to the departure of the newly appointed Ambassador to Pekin, his Excellency was made conversant with the position of the salt trade in England, and the facilities it afforded for supplying the Chinese with a pure manufactured article at a very moderate cost, his Excellency being also furnished with samples of salt to illustrate the superiority of British salt over the article used in China.

"That the consumption of salt is, of necessity, enormous amongst the teeming population of China, and an easy method for collecting a large revenue upon imported salt would thus be pointed out to the Chinese Government.

"That the example of India may be cited as an analogous case, inasmuch as a change in the fiscal regulations concerning salt there, has led to an import of about 100,000 tons per annum of English salt at Calcutta (Bengal being the only Presidency where it is yet practically admitted), upon which a revenue of nearly half a million sterling per annum is collected by the Government at a very small cost to themselves, and your memorialists believe that his Excellency would have no difficulty in proving to the Chinese Government that it would be equally to their interest to admit English manufactured salt on similar principles.

"Your memorialists, therefore, pray your Lordship will be pleased to direct the special attention of his Excellency the Ambassador to the Court of Pekin to this subject, which is of the most vital consequence to the salt and shipping interests of this country, both suffering greatly from a want of outlets and employment of their respective produce and property, and your memorialists bring this subject under your Lordship's notice in this form, at the recommendation of several Members of the House of Commons and of the Lords, who take a deep interest in the question, assured that it will thus receive your Lordship's prompt and earnest attention.

"W. WORTHINGTON, Chairman.

"Dated Northwich, 25th July, 1859."

The Chamber look forward to a satisfactory result from their labours in this direction; and as regards India, the report states that it only appears to be a question of time, in making our own authorities fully comprehend what is wanted from them. It appears from a letter addressed by the Secretary to Mr. Tollemache, M.P., on the 25th July last, that the principal requirements are:—Bonding accommodation for salt at Bombay and Madras on the same principle as at Calcutta; increased bonding storage for salt at Calcutta; equalisation of duties (excise and customs) at all the Presidencies, as suggested by the Chamber of Commerce at Calcutta to Lord Canning; that the Government should give up the system of manufacturing salt in India themselves, thus interfering with private enterprise.

Attention is drawn to the fact that the price of labour has risen very much in India, so that there is less reason for making salt as a means of employing an idle population.

The facility of raising a revenue on salt imported should not be overlooked, being an important question in the present depressed state of Indian finances.

No communication has been made by the Calcutta Chamber of Commerce in answer to the letter of this Chamber, asking for their co-operation, and for such suggestions as might be useful in guiding their proceedings; but in their memorial to the Governor General some time back, the Calcutta Chamber made strong allusion to the raising of revenue by additional duty on salt, and equalising the duty at the other Presidencies of Bombay and Madras, where it was considerably less than in Bengal. Sir Charles Wood, on propounding his financial statement for India, looked to additional revenue (£300,000) from an increase of the salt duty at these Presidencies, so as to equalise them with those of Calcutta—a measure that would speedily open to us these markets, as it would then become an object to pay the same duty on a superior article rather than on an inferior one. The rate of duty at the three Presidencies is now as follows:—

Calcutta, 5s. per maund.		According to the information given by Mr. Prideaux, of the East India House.
Bombay, 2s.	do.	
Madras, 1s. 6d.	do.	

The Report goes on to say that, in the present position of Indian finances the raising of a large revenue on imported salt will no doubt occupy the serious attention of the local government as well as of the imperial one, and it is believed this may be done without unduly pressing on the native population, as much abuse is said to exist in the mode of administering the excise duties as well as in the process of manufacture adopted by the late Company. A duty levied on imported salt goes at once into the Exchequer at a very moderate expense for its collection, whereas, under the present system, the nett amount of revenue on salt is not believed to correspond at all with the gross amount.

Another market to which the attention of the Chamber has been directed is that of the River Plate, where for many years an import of salt from Europe has taken place, averaging from 30,000 to 50,000 tons per annum; it was supposed that English salt would not suit for the curing of hides and salted beef, and that restrictions of government existed which prevented the importation of English salt, but experiments made with several cargoes from Liverpool have proved not only that the salt will rank even superior to that of Cadiz, which is the most esteemed there, but the Liverpool shipments have arrived opportunely and left a considerable profit. An attention to the quality of rough-grained salt, suitable for River Plate consumption, is therefore very desirable.

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* An account of some of the proceedings of this Chamber appeared in the *Journal*.—(See Vol. VI., p. 678.)

ON A UNIVERSAL PRINTING PRESS.*

By T. J. Silberman, Jr.

A press on this principle, and adapted to all kinds of printing, has been patented by Mr. Silberman, pupil and assistant in physics to the late M. Savart, and to M. V. Regnault, at the College of France.

Pascal's law is this:—"Whatever be the amount of pressure brought to bear upon any point in a contained fluid mass (whether the fluid be a liquid, or steam, or gas), this pressure is distributed with perfect and entire equality among all parts of the mass, and consequently with perfect equality over all parts of the surface of the vessel which contains the mass;" so that if this vessel or a portion of it be pliable and elastic, it will communicate the same pressure which it receives to paper, cloth, or any other similar substance, laid upon an unyielding engraved surface. And the invention consists in printing by thus applying the pressure of a fluid to a yielding surface laid against an unyielding engraved surface; and this whether the surface printed be that of the vessel itself, which thus becomes the press,—or whether it be communicated to another interposed yielding surface from the pliable and elastic side of the vessel, so as to print plane, curved, or angular surfaces,—or whether the material to be printed be paper, felt, textile fabric, caoutchouc, leather, bladder, ceramic paste, or glass, crystal, or enamel softened by heat,—or whether it be used for the purpose of peripheric printing, as in the printing of terrestrial and celestial globes, of vessels of glass and earthenware,—or as a modification of the presses in use for other kinds of printing.

The application of this principle to the peripheric printing of globes, and of vessels of glass and earthenware, is the subject of a separate paper. At present let us consider merely its application to printing upon plane surfaces, as well as the different modifications it admits of, so as to suit the different kinds of printing; and lastly, of its peculiar advantages over other methods.

The following are some of the methods in use for the practical application of the principle:—

1. A strong shallow basin of tough metal is required, with a triple stop-cock at bottom, admitting at pleasure the sort of fluid intended to be used, whether it be atmospheric air, steam, or (when great pressure is required) water, with hydraulic pressure. This basin is filled with water, and covered by a tympan formed of a sheet, or of several sheets thick of caoutchouc firmly clasped at the edges in an iron frame. A moveable plate of iron, strengthened by stays, is attached by strong hinges to one of the edges of the tympan frame. This plate, when shut down upon the surface of the tympan, forms the unyielding portion of the press, and supports the engraved plate against the substance intended to be printed, which receives by means of the tympan the pressure produced upon the water at the bottom of the basin.

In order to retain this plate firmly in its place upon the tympan, its edges as well as those of the basin should be bevelled in such a manner as to lock the whole way round in a collar with a corresponding groove; this collar opens and closes upon the edges the whole way round by means of two hinges and wide-threaded strong screws, or else by means of a cam or eccentric lever lock. A very simple contrivance compels regularity in the proceeding, and prevents accidents, by locking the stop-cock, and preventing the admission of pressure into the basin, until after the plate shall have been shut down and firmly locked upon the tympan.

The engraved plate may either be permanently fastened upon the iron plate, or it may be run into its place in a groove, so as to admit of being easily removed and replaced after each impression, as in the case of copperplate printing.

When it is intended to print paperhangings or cloth with dies, an iron frame instead of the solid plate above described is attached to the hinges; a strong iron axle passing through gudgeons on opposite sides of the frame carries a panel fitting into the frame, and upon this panel the die is fixed. The panel thus revolving completely on the axle at the same time that the frame is raised upon its hinges to a vertical position, admits of the face of the die being alternately brought into contact with the tub, when it is charged with colour, and with the surface of the material intended to be printed.

2. Another form of the press is one in which the tympan is moveable upon hinges, and fastens down upon the plate, which in this case is the fixed part of the press, and upon it the die is laid. In lithography or typography there must of course be a hollow in the plate corresponding to the thickness of the stone or type used.

This was the form adopted for the first experiment with the press; its tympan consisted of two sheets of vulcanized caoutchouc fastened to the basin, and secured by strong screws; the tympanum and the plate, instead of being locked together while the pressure was on by means of the collar above described, were kept together at one end by the hinges, and at the other by a cam or eccentric lever lock, working from an iron arch like a common letter-copying machine, and to which two moveable claws are attached, which, when the lever is worked, grasp and secure the ends of a strong bar across the centre.

3. It may sometimes be desirable to place the press vertically, notwithstanding the slight, and in fact almost imperceptible difference in the pressure at the top and at the bottom of the basin, and which is produced by the column of water in the basin itself. When air is used this inequality is absolutely imperceptible, but on account of the great compressibility of air a much larger quantity of air must be admitted that when water is used; for instance, if the basin is one metre square and one millimetre deep, and consequently holds one litre, it will require one litre of air to produce a pressure of a single atmosphere, and ten litres to produce a pressure of ten atmospheres.

The vertical position is particularly well suited for very large plates, say five or six feet square; the copperplate can if necessary be heated from behind, and the workman can apply the ink in a standing posture. The press in this case would open like a door, and large presses thus arranged would occupy but little space, would be easily worked, would render the application of the ink less fatiguing, and would save rent in office space, for six vertical presses take no more room than two horizontal presses. In this way the printing of very large maps will become not only possible but cheap.

As to the purposes to which it can be applied:—1. It is equally suitable to all kinds of ordinary printing, whether copperplate, lithography, typography, paperhangings, or wood engraving, for it fully admits of the depth of shade in certain parts of the engraving being modified according to taste, without altering the engraving by the usual contrivance of folds of paper cut out so as to throw the part into suitable relief.—2. It is peculiarly suitable for polychromic printing, whether typographic, lithographic, or copperplate, and the pressure being only in a vertical direction, the paper or cloth is not liable to be altered in size or form by the pressure, and admits of accurate fitting to the guide pins as often as the number of colours used may require. 3. It is equally suitable for printing upon all sorts of material, whether paper, cloth, ceramic paste, felt, leather, or caoutchouc. 4. It prints with a single impression very much larger plates than it has heretofore been possible to do, and it ensures the colour being uniform over the whole surface. 5. It admits of being used for stereotype and other casts from ordinary printing type, and does not require that frequent touching with the brush which wears away the characters so quickly.

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* From the Civ. Eng. and Arch. Jour.

As to the pressure:—1. The pressure being that of a fluid communicated through a uniformly yielding surface, will be absolutely equal at every point of the surface, consequently there will be no danger of partial pressure on the plate, nor need there be a pressure upon any part of the plate beyond what is necessary, so that the maximum result is thus obtainable with a minimum of pressure. 2. Any amount of pressure required can be easily obtained. 3. The amount of pressure can be ascertained with precision (for instance, by Bourdon's metallic manometer), and diminished or increased to the exact extent which may be required. 4. Perfectly plane surfaces are no longer the only surfaces capable of being printed. 5. Convex or concave surfaces can thus be printed.

As to make, form, and size:—1. The press is extremely simple in its construction; almost all the pieces are cast exactly as they are used, and require very little fitting. 2. It can be made of any strength required. 3. It requires no troublesome alterations when the purpose for which it is used is altered. 4. It fits in a very small space, being only four or five inches wider than the printed sheet, whereas the presses hitherto in use are at least four times wider than the printed sheet. 5. It thus admits of being worked in a small and comparatively inexpensive office. 6. Its size being so small, a printer can have several presses of different sizes in his office, so as to be no longer forced to use his large presses for small sheets. 7. It is easily taken asunder and moved. 8. It is on this last account, and the almost impossibility of breakage, admirably adapted for exportation.

As to its working:—1. It requires hardly any effort, and entirely dispenses with the severe labour which the winches and pedals of the present lithographic press require,—with the rolling of copperplate printing,—with the difficulty of charging the blocks with colour, as well as with the danger of working the huge lever of the ordinary press in printing paperhangings; and as it requires less exertion on the part of the workmen, it gives them more time to attend to the quality of the work, and thus tends to elevate their character. 2. A much greater number of impressions can be taken in a given time than was possible heretofore. 3. The manner of using the press can be learned in an hour. 4. No modification of the press, or any of its parts, is necessary when a change is made in the size of the sheet, or otherwise in the nature of the work to be printed. 5. The impression is uniformly even and invariably successful. 6. There is no longer any danger of distorting or of lengthening by rolling out the plates in copperplate printing,—or of breaking the lithographic stones by the uneven pressure of the scraper. 7. The simplicity of the contrivance for locking the press, and for admitting and shutting off the pressure, renders all mistakes impossible. 8. There is no part of the press which is expensive from excessive wear and tear; and even when worn out, both the caoutchouc and the metal have a considerable value as raw material.

As an investment, the great simplicity of the machinery, and the small expense of fitting, will allow the press to be sold extremely cheap.

As to the sort of pressure to be used,—steam pressure may be adopted, or the pressure of expanded or condensed air, the hydraulic press, the screw, the cam, or the eccentric or knee lever lock. If steam is used, the waste heat will warm the plates in copperplate printing, and will thus get rid of the charcoal dust, so injurious to the health of the workmen.

The expenditure of water or steam may be estimated by considering the surface of the caoutchouc as the surface of a piston, and its depression joined to that of the printed surface as the stroke of the piston; consequently, when the basin is one metre square, there is an expenditure of one litre of air or water for each millimetre in the depression of the surface.

Water appears on the whole the most desirable agent, on account of its non-compressibility and of the small quantity required in order to produce very considerable pressure, as also on account of its non-expansibility, which prevents the possibility of an explosion, for if any breakage takes place the water simply runs out. In experiments which were made with a pressure of from 20 to 30 atmospheres, before perfecting the press, the vessel repeatedly burst, with no greater injury to those engaged than a few splashes on their clothes.

IRON-PLATED SHIPS.

A series of experimental trials have been recently carried on at Portsmouth with a view of ascertaining the amount of resistance offered by iron and steel plates of various manufactures when opposed to heavy ordnance at a short range. The trials are understood to have reference to the future coating of the steam ram now in progress of construction. The practice has been carried on from the Stork gun-boat, tender to her Majesty's ship Excellent, gunnery ship in Portsmouth harbour, both from a 32-pounder and a 95-cwt. gun, the latter throwing a solid 68-pound shot, with 16 lb. charge of powder; the distance of range 200 yards. At this distance the results of the experiments have demonstrated in the clearest possible manner that no iron or steel plate that has yet been manufactured can withstand the solid shot from the 95-cwt. gun at a short range. The first shot would not penetrate through the iron plate, but it would fracture it, and on three or four striking the plate in the same place, or in the immediate neighbourhood, it would be smashed to pieces. As the results of the trial affected the steel plates, it proved that a steel clothed ship could be far more easily destroyed than a wooden-sided one, and that, on the smashing in of one of the steel plates, the destruction of life on the armed ship's decks, supposing the broken plate to be driven through the ship's side, would be dreadful, from the spread of the splintered material. At from 600 to 800 yards iron-clothed vessels would be in comparative safety from the effects of an enemy's broadside, but it must be borne in mind that the effects of concentrated firing have yet to be ascertained on the sides of an iron or steel-clothed ship, and account must also be taken of the damage the woodwork forming the inner sides of such a ship would receive from the driving in of the broken plates, and which, as far as the present experiments have illustrated, would appear to prove that an iron or steel clad-ship, on receiving a concentrated broadside from a frigate, armed in a similar manner to the Mersey, and struck near her waterline, must sink with her armour on her back.

Home Correspondence.

EXHIBITION IN 1862.

Sir,—It was suggested, I think by a writer in the *Daily News*, that a declaration on the part of England to hold a second Universal Exhibition, would be a fitting inauguration of an European peace, and a writer in the *Observer*, within the last few days, proposes that Government should at once declare its intention to hold such an Exhibition in 1862, and take steps to carry it out as a national measure, not to be interfered with by private bodies, such as the Society of Arts. Lord Lansdowne has said that "Government is the worst of traders, the worst of cultivators, and the worst of teachers." Is not the truth of the above remark made more and more evident every day? Does not every public department illustrate the fact that Government is the most dilatory of masters, the most wasteful of spendthrifts, and the most partial of employers that an artistic and commercial community can have to deal with?

Would England ever have seen an Universal Exhibition in 1851 if the Society of Arts had, not as it were, forced it upon the country? Have the Royal Commission, as Trustees of the surplus funds of the Exhibition of 1851, and which may be called a Government body, ever voluntarily proposed to hold a second great International Exhibition of the world's industry, as they were bound to do under the original deed of trust, and in accordance with the conditions under which the subscriptions from Sheffield and other towns were given, viz., upon the undertaking that should any surplus remain from the Exhibition of 1851, her Majesty's Commissioners would apply the same to purposes strictly in connection with the ends of the Exhibition, or for the establishment of similar Exhibitions in future?

Do great national undertakings ever emanate voluntarily from the Government of this country, and is it at all likely that England will ever see a second Universal Exhibition if it is left to the voluntary action of Government to propose and carry it out? I think not. I therefore sincerely trust that the hope held forth by the Chairman of the Council, in his address in June last, will be realised, and that so soon as the Society reassembles after its recess we shall see a declaration issued by the Council of its intention to at once renew its endeavours to carry out a second Universal Exhibition of the world's Art and Industry in 1862.

There is reason to hope that the war which threatened seriously to disturb the peace of Europe having passed away, and peace being re-established, a second Universal Exhibition would be calculated to bring about a renewal of friendly relations with our continental neighbours, inducing a friendly rivalry and competition between nations, and tending greatly to that extension of commerce which is sure to produce an increased desire on the part of all for enduring peace. An exhibition which really represents the world's industry can only be carried out successfully during peace, for how else would it be possible to gather the products of forty nations under one roof, as was the case in 1851. Many more should be added in 1862, seeing how much more generally the character and importance of such exhibitions is understood.

It cannot be denied that England, since 1851, has made great advances, especially in her Art Industries, and that she would now be able to stand forward much more boldly in competition with foreign countries than on the last occasion. France, too, which undoubtedly bore away the palm for her artistic displays of bronze, zinc, and other metal works, as well as for many other branches of applied design, would doubtless be glad to show how far she has profited by the visit of the ninety foremen and many first-rate workmen, who were sent over free to study the Exhibition of 1851, and the manufactures of Beauvais, Sèvres, Gobelins, Chalons, Aix, and Angers will be anxious each to show how they profited by the Exhibition of 1851, and that more recently held in Paris in 1855.

Moreover, the Art workmen of England will be desirous of showing how they have profited by the study of the works of Ancient Masters exhibited at Manchester, and the increasingly useful and beautiful collection of originals and copies of Art workmanship collected at the Brompton Museum.

The education of artisans in their respective trades has been greatly extended and improved throughout England, and the principles upon which manufactures of every kind are carried on are better understood by the rising generation of workmen than they were at the time of the last Exhibition. English artizans will therefore be in a position to take advantage more fully of future Exhibitions.

Having thus been employed in the education of producers, we are bound to take the most effective of all steps for the education of purchasers, namely, the holding another Universal International Exhibition.

Fearing to trespass longer on your space,

I am, &c., H. G. HAWARD.

Bow.

THE STONES OF LONDON.

SIR,—With reference to the letter of your correspondent, D. T. Ansted, on the subject of the incrustation of soft stone with soluble silicate of potash or soda, I beg to state that it is highly improbable that we shall ever very closely imitate the productions of nature by artificial means.

The wisest course, therefore, will be to make use of well-known durable stone only, and abandon all such architectural sculpture as, on account of expense, can only be executed in a soft perishable material, and which in the great metropolis is doubly useless. Soft stone will not stand our London atmosphere, and if it did, the black incrustation of sooty matter in the carved receptacles so disfigures it as to render it exceedingly disagreeable in appearance, as well as disgraceful to a people so advanced as we are. We are, indeed, fast going back to the dark (black) ages.

The great work of the present day, the New Palace of Westminster, already presents the appearance of a fantastic mass of charcoal and coke, totally incompatible with architectural beauty—the outline only being visible. But as that is cut up by innumerable pinnacles, surmounted with rusty iron vanes, stuck about them in every possible and impossible position, that outline does not materially differ from a view of chimney pots over any part of London. The capitals of the portico of St. Paul's are gone, the stone (Portland) being too soft to retain the carbonaceous incrustation. The statue of her Majesty, in white marble, at the Royal Exchange, weeps tears of soot, and the drapery is so smeared and smutted as almost to put to shame a kitchen scullion. It is not, however, in London only that we are disgraced by elaborate carving in soft stone. Look at Exeter Cathedral, where the poor saints are suffering perpetual martyrdom in the loss of hands and feet, heads and noses.

Seeing the great variety of choice, why has the inexhaustible deposit of Plymouth marble, as well as the old quarry of "Tilly Whim," on the coast of Dorset, been entirely overlooked by the professors appointed to search for durable stone for the construction of the New Houses of Parliament, intended, I suppose, to be a monument of our magnificence to after-ages, which they will never reach without perpetual repair and reconstruction.

May I be allowed to ask, also, why professors of geology were needed at all, when there was an eminent architect appointed, whose superlative talent as a designer has been so misdirected by the barbaric fashion of the day. An architect, according to Vitruvius, is bound to be acquainted with all the sciences connected with his profession. Knowledge of the most durable and suitable materials, and where to be found; Acoustics, Pneumatics (ventilation), Thermics (comfort, winter and summer), as well as a host of others too numerous to mention. In the present case a professor was called in to direct the ventilation at a great cost to the nation, without any very beneficial results, as he persists in ventilating upwards through the floor, instead of downwards. I may also ask who permitted the intolerable blunder of passing the ventilating shaft through the clock-tower, intended to carry four dial-plates, three being easy, but the fourth, owing to the backward movement, of difficult accomplishment.

I am, &c.,

HENRY REVELEY.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 9th*, 1859.]

Dated 5th August, 1859.

1806. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—A system of columns or monuments to be employed as sentry boxes, branch post and other offices, telegraph and fire-engine stations. (A com.)

Dated 13th August, 1859.

1869. R. D. Clegg and T. Saunders, Islington—Imp. in locks.

Dated 23rd August, 1859.

1926. W. H. Hill, Birmingham—An imp. in the manufacture of boxes or cases, and in fastenings for the same.
1928. W. Hollins and F. Hyde, Glossop, Derbyshire—Imp. in power looms for weaving, part of which improvements is also applicable to other machines driven by power.
1930. T. Richardson, New Bridge-street, Newcastle-on-Tyne—Imp. in treating copper ores.

Dated 24th August, 1859.

1931. G. Pearson, Manchester—Improved machinery for manufacturing boots and shoes.
1933. J. Henry, Bury, and J. E. H. Andrew, Audenshaw, Lancashire—Imp. in looms for weaving.
1934. J. Blake, Accrington, Lancashire—Imp. in steam and vacuum gauges.
1935. D. Russell, 1, Grove-cottage, Southampton-street, Camberwell, and J. Russell, 6, Devonshire-terrace, Queen's-road, Peckham—Improving the means of docking and lifting ships out of the water, for the purpose of examining and cleaning their bottoms, effecting any necessary repairs, fixing new screw propeller, rudder, raising sunken vessels, or anything else for which it is desirable to get at any portion of a vessel generally under water.
1937. J. Murray, Dublin—Imp. in the preparation and bottling or preserving of carbonated cod liver oil and other aerated liquids.
1938. C. T. Judkins, 22, Ludgate-street, London—Imp. in sewing machines.

Dated 25th August, 1859.

1939. H. Smith and T. W. Ashby, Stamford—An improved construction of harrow. (A com.)
1940. L. Perkins, Francis-street, Gray's-inn-road—Imp. in mills. (A com.)
1941. A. P. Chamberlain, New Orleans, U.S.—Imp. in machinery or apparatus for cutting cork, part of which improvements is also applicable to cutting paper, caoutchouc, and other substances.

Dated 26th August, 1859.

1943. J. Furrell, 5, Upper Phillimore-place, Kensington—Lock protector, consisting of an adhesive shield or cover to be placed over the keyhole of a lock for the purpose of ensuring that any access to the interior of the lock shall be readily detected.
1945. T. Bird, Manchester—Imp. in castors.
1946. J. M. Hetherington, Manchester—Imp. in machinery or apparatus for carding cotton, wool, and other fibrous materials.
1947. H. Grundt, America-square—Imp. in life boats.
1948. W. MacLellan, Glasgow—Imp. in rolling or shaping iron for railway spikes and other purposes.
1949. C. T. Boutet, 12, Chenies-street, Tottenham Court-road—A new mechanical mill proper for milling every sort of grains, dried or torrefied, such as coffee and cocoa.

Dated 27th August, 1859.

1950. C. Hanson, Huddersfield—An imp. in the chronometer escapement of a watch.
1951. F. Wrigley, Manchester—Certain imp. in the construction of the permanent way of railways.
1952. J. R. Rostron, Edenfield, Lancashire—Imp. in furnace bars.
1953. W. H. Balmain, St. Helens, Lancashire—Imp. in the manufacture of glass, and other vitrified substances.
1954. T. Craven, Scarborough—Imp. in ball cocks or valves.
1955. G. Bell, South Inch Michael, Perth, N.B.—Imp. in reaping and mowing machines.
1956. J. Heckethorn, 32, Stanmore-street, Caledonian-road—Imp. in candles and wicks, and also in lamps and candlesticks for using with the same.
1958. E. Rettig, New-cross, Kent—Imp. in the form and construction of anchors. (Partly a com.)

Dated 29th August, 1859.

1960. T. Meriton, 39, Pinnasberg, Saint Pauli, Hamburg—Imp. in governors for regulating the speed of marine and other engines and machinery.
1961. C. Kerman, Vulcan Iron Works, Millbrook, near Southampton—An apparatus to prevent the sinking of vessels through leakage, for lifting and floating vessels off when stranded, and for raising and floating sunken vessels.
1962. J. R. Howarth, Manchester—Certain imp. in machinery or apparatus for calendering and finishing textile fabrics or other surfaces
1963. W. Clark, 53, Chancery-lane—Certain imp. in sewing and stitching by machinery. (A com.)
1965. D. Todd, Bridge-of-Weir, Renfrew, N.B.—Imp. in machinery or apparatus for carding and treating or preparing fibrous materials.
1966. B. Baugh, Bradford-street, Birmingham—Certain improved machinery or mechanical arrangements for raising or giving form to articles formed of sheet metal, such as knobs, thimbles, ferules, and parts of umbrella and parasol furniture, button shells, and other such like small articles.
1967. G. S. Fleming, 498, New Oxford-street—A head-rest, suitable for keepiug the head in a comfortable position in travelling, sitting, or lying down.

Dated 30th August, 1859.

1969. J. B. Barnes, Summer-lane, and J. Loach, Caroline-street, Birmingham—Certain imp. in oars for impelling boats, as also in the row-locks in which they work.
1971. J. Hare, Hamstead-road, Handsworth, near Birmingham—Imp. in pianofortes.
1975. C. Chambers and J. Chambers, Archer-street, Westbourne grove, Middlesex—Imp. in apparatus for sawing staves and other forms of wood.
1977. R. F. Drury and E. Drury, Sheffield—Imp. in vices.

Dated 31st August, 1859.

1979. J. Nuttall, Todmorden—Certain imp. in and applicable to machinery used in preparing and spinning cotton and other fibrous materials.
1981. R. Beverley, Leeds—Imp. in wet gas meters.
1983. S. Middleton, Blackfriars-road—Imp. in the mode or method of uniting and otherwise manufacturing articles of leather, and such like materials, and in the apparatus and machinery connected therewith.
1985. A. Smith, Brentwood—Imp. in machinery for the preparation of cocoa nut fibre.
1991. J. Chatterton, Devonshire-street, Islington—Imp. in the manufacture of tubes of gutta percha, and other substances capable of being moulded in a similar manner when in a plastic state, and also in coating wire and other cores with such substances.

Inventions with Complete Specifications Filed.

1942. M. Billing, High Holborn—An improved mode of ornamenting and finishing certain articles of hardware.—26th August, 1859.
1944. M. J. Stark, Norwich—Producing a new chemical or artificial manure from bones, and all such animal and fatty matters.—26th August, 1859.
2032. J. J. Sieber, 5, Baring-street, New North-road—Imp. in power-looms.—Dated 6th September, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, September 9th*, 1859.]

September 8th.

613. J. Erwood & J. Skertchly.
621. J. Yuill.
623. H. Lodge.
627. S. Wheatcroft.
629. F. Clark.
635. J. T. Calow.
636. J. Thornton.
637. J. Court.
638. R. Allison.
639. J. Macnab.
640. R. Waller.
641. R. A. Brooman.
644. D. Joy.
649. W. Langton.
668. J. Clark.
670. H. Bessemer.
722. W. Weild.
753. W. Clark.
772. C. J. Richardson.
778. T. Carr.
1042. T. Holt and J. Brown.
1347. A. Suter.
1454. A. V. Newton.
1527. W. E. Newton.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette, September 9th*, 1859.]

September 6th.

2087. F. Estivant.
2095. W. Petrie.

September 7th.

2093. F. M. Herring.
2126. J. Milnes & W. Thompson.
2130. A. D. Bishod.

[*From Gazette, September 13th*, 1859.]

September 8th.

2089. J. Fowler, jun,
2113. J. Taylor.
2129. A. Chaplin.
2149. C. Hill.

September 10th.

2140. J. Elliott.
2144. R. Peyton.
2150. S. C. Lister.
2165. G. T. Bousfield.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 23, 1859.

ON THE RELATIVE POWER OF METALS AND ALLOYS TO CONDUCT HEAT.

By F. Crace Calvert, F.R.S., and Richard Johnson, F.C.S.

(Concluded from page 681.*)*

Alloys containing an Excess of the worse conducting Metal.

The study of this class of alloys being most interesting, we have made many experiments in order to discover why the presence of one metal completely annihilates the conducting power of the other, especially when the latter is the better conductor of the two.

The following series will illustrate the above statement.

Lead and Antimony.

Formula of the alloys and per-centage.	Found (Mean).	Calculated.	Silver = 1,000.	
			Found.	Calculated.
1Pb=61·61 1Sb=38·39	6·05	8·00	190	251
1Pb=47·60 2Sb=52·40	5·90	7·57	185	237
1Pb=34·86 3Sb=65·14	5·85	7·18	184	225
1Pb=28·63 4Sb=71·37	5·70	6·99	179	219
1Pb=24·30 5Sb=75·70	5·70	6·85	179	215

It will be perceived, on looking over the results obtained, that all these alloys conduct heat almost as if the square bars examined were composed of pure antimony, the conducting power of which is 6·12; for if lead, which has a conducting power of 9·17, had influenced the passage of heat through the bars, the conducting power of the alloys would have been much higher, as shown by the column of theoretical conductibility.

The same results were obtained with the following series, composed of bismuth and antimony:—

Antimony and Bismuth.

Formula of the alloys and per-centage.	Found (Mean).	Calculated.	Silver = 1,000.	
			Found.	Calculated.
1Sb=37·74 1Bi=62·26	1·97	3·52	62	110
1Sb=23·26 2Bi=76·74	1·87	2·92	59	91
1Sb=16·81 3Bi=83·19	1·90	2·64	59	83
1Sb=13·17 4Bi=86·83	1·50	2·47	47	77
1Sb=10·82 5Bi=89·18	1·55	2·39	48	75

We now describe the most important series of this class of alloys, namely, that consisting of those composed of tin and copper. (See below, Copper and Tin, Table I).

It is very interesting to observe, that although these alloys contain such different quantities of copper, viz., from 9·73 to 34·98, and this of a good conducter of heat, still no influence is exercised by it on the conductibility of the alloys, for they all give the same results as if the square bar experimented upon were composed of pure tin. Another fact, which increases the importance of the

Copper and Tin.—Table I.

Formula of the alloys and per-centage.	Temperature of the 50 cub. cent. before beginning.	Temperature of the 50 cub. cent. after 15 minutes.	Conductibility found.	Mean.	Calculated.	Silver = 1,000.	
						Found.	Calculated.
	deg.	deg.					
Cu = 34·98 Sn = 65·02	20·8 19·8	34·0 33·1	13·2 13·3	13·25	17·80	415	558
Cu = 21·21 2Sn = 78·79	19·4 19·5	33·2 33·2	13·8 13·7	13·75	16·08	431	504
Cu = 15·21 3Sn = 84·79	19·2 19·45	33·80 32·85	13·6 13·4	13·50	15·33	423	481
Cu = 11·86 4Sn = 88·14	18·9 19·0	31·7 32·1	12·8 13·1	12·95	14·92	406	468
Cu = 9·73 5Sn = 90·27	19·4 19·7	32·0 32.4	12·6 12·7	12·65	14·65	396	459

Copper and Tin.—Table II.

Formula of the alloys and per-centage.	Temperature of the 50 cub. cent. before beginning.	Temperature of the 50 cub. cent. after 15 minutes.	Conductibility found.	Mean.	Calculated.	Silver = 1,000.	
						Found.	Calculated.
	deg.	deg.					
Sn = 38·21 3Cu = 61·79	21 20·6	36·7 36·4	15·7 15·8	15·75	21·37	494	670
Sn = 31·73 4Cu = 68·27	18·2 18·0 19·3 18·4	23·1 23·1 25·25 23·30	4·9 5·1 4·95 4·90	4·96	21·88	155	686
Sn = 27·10 5Cu = 72·90	17·7 18·7 17·9	24·2 25·3 24·5	6·5 6·6 6·6	6·6	22·50	207	705

bronze alloys, is the difference which they present in their conductibility when they contain an excess of copper, not only with regard to the above series, but also between each alloy, all of which have a conducting power of their own. (See last page, Copper and Tin. Table II.)

The results obtained with Sn 4Cu were so extraordinary, that the bar first prepared was remelted and cast, from a fear that there might be in the mass some vacant space or hole impeding conduction; but as it yielded the same results when submitted to experiment, we decided to make a new bar, weighing most carefully the metals to be used and also the bar when cast; the loss being only 0·5 per cent., we were satisfied that the bar was sound, and still it gave the same figures as the bar first experimented with; and therefore we concluded that an alloy of tin and copper containing 68 per cent. of the latter metal, has a conducting power five times less than it should have according to theory. From the above results it is highly probable that these alloys of tin and copper, and especially the three last, are definite chemical compounds; for if they were mixtures, they would conduct heat in ratio to the equivalents of the metals composing them, and would not each have a peculiar and different conductibility. These views are substantiated by experiments which we have made with square bars composed of sectional parts of copper and tin. These bars were made by a very skilful optician of this town, Mr. Dancer, and the parts soldered together with tin solder in so thin a layer, that it did not occupy a space of 0·55 millim. in the five junctions.

The first two bars we employed were of the usual dimensions, and composed of cubes of copper and tin, each 1 cub. cent., arranged in the following order:—

Bar No. 1, 2 cubes of tin, 2 cubes of copper and 2 cubes of tin. Bar No. 2, 2 cubes of copper, 2 cubes of tin and 2 cubes of copper. The results arrived at were—

	Found (Mean).	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Bar No. 1	17·25	18·12	541	568
Bar No. 2	18·35	22·23	575	696

Therefore these two bars conduct heat nearly as the theoretical results indicate; the slight difference of 1 or 2 degrees between the obtained and calculated figures being probably due to the influence of the tin solder existing between each cube, and to the cubes not being perfect in all their dimensions. Still, what different results these bars give, as compared with alloys having nearly the same per-centage of tin and copper! for we have

		Obtained.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
Bar No. 1. Tin .... 62·39 Copper...... 37·21 100 00	Conductibility	17·25	18·12	541	568
Alloy:— 1 equivalent of Tin......... 65·02 1 equivalent of Copper ... 34·98 100·00	Conductibility	13·25	17·80	415	558
Bar No. 2. Tin .... 29·33 Copper. .... 70·67 100·00	Conductibility	18·35	22·23	575	696
Alloy:— 1 equivalent of Tin......... 31·73 4 equivalents of Copper ... 68·27 100·00	Conductibility	4·96	21·88	155	686

These results appear to us perfectly to substantiate our views, viz., that these alloys are definite chemical compounds, and not a mixture of metals; for if they were the latter they would conduct heat as the bars, and would not have a conductibility of their own. We deemed it advisable to have a third bar made, in which the cubes of copper and tin alternated, and these are the results obtained—

	Found.	Mean.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
Bar No. 3............	18·1 18·3	18·2	20·22	570	634

The composition of this bar is intermediate between that of the alloys Sn 2Cu and Sn 3Cu, which contain in 100 parts (see top of next page):—

Notwithstanding these facts, we were not prepared for the curious results which we obtained with the following bar, composed of two longitudinal bars of tin soldered to two of copper and placed in juxtaposition (Bar No. 4); for although it contained in 100 parts the same weight of tin and copper as the last bar, it conducted heat at quite a different rate; in fact, its conductibility was the same as if the bar was entirely composed of pure copper, and did not contain half its bulk of tin.

	Found.	Mean.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
Bar No. 4............	26·5 26·4	26·45	20·22	829	634

These interesting results were confirmed by having

		Obtained.	Calculated.	Silver = 1,000.	
				Found.	Calculated.
1 equivalent of Tin......... 51·83 2 equivalents of Copper... 48·17	Conductibility	13·65	19·87	428	623
100·00					
1 equivalent of Tin......... 38·21 3 equivalents of Copper... 61·79	Conductibility	15·75	21·27	494	670
100·00					
Whilst the bar is composed of— Tin......... 45·36 Copper ... 54·64					
100·00					
And conducts as a mixture, or		18·20	20·22	570	634

similar bars made of copper and zinc, (Bar No. 5) and copper and lead (Bar No. 6).

	Found.	Mean.	Calculated.	Silver=1,000.	
				Found.	Calculated.
Bar No. 5. Copper 56·12 Zinc 43·88	26·8 26·9	26·85	23 33	842	731
Bar No. 6. Copper 43·42 Lead 56·58	23·0 23·1	23·05	16·42	723	515

We wished to ascertain if the extent of surface of the copper in contact with the other metal exercised any influence. We therefore had a bar made in which there was the same relative weight of tin and copper, but in which the surface of the two metals in contact was only one-half of that of the bar No. 4. This was effected by soldering together one bar of copper, 1 centim. wide and 5 millims. thick, to a similar one of tin (Bar No. 7); and although the results leave some doubt whether the surfaces have an action, still the figures are sufficiently different to deserve serious consideration.

	Found.	Mean.	Calculated.	Silver=1,000.	
				Found.	Calculated.
Bar No. 7...............	24·2	24·15	20·22	757	634
Bar No. 4...............	26·5	26·45	20·22	829	634

The conductibility of these bars, and especially of Nos. 4 and 6, being equal to that of rolled copper, with which they had been made, we wished to see what would ensue, if bars of the same copper, and having the same diameter or surface as that of the copper in the above bars, were subjected to experiment. These are the results:—

Bar No. 8. Square copper bar of 7 millims. square, or one-half the bulk of the bar usually employed.

Found.	Mean.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
19.1 19·1	19·1	17·73	599	591

Bar No. 9[*]. Bar of rolled copper, 5 millims. thick and 1 centim. wide.

Found.	Mean.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
19·4 19·3	19·35	18·86	606	591

Therefore there cannot remain a doubt that the presence of tin, zinc, or lead in the bars exercises a marked action on the conductibility of the copper; for we have—

1 centim. square bar of rolled copper	26·95
7 millims. square bar of rolled copper	19·12
5 millims thick 1 centim. wide bar of rolled copper	19·35
1 centim. square bar of rolled copper and tin.	26·45
1 centim. square bar of rolled copper and zinc	26·85
1 centim square bar of rolled copper and lead[†]	23·05

ALLOYS IN WHICH THERE IS AN EXCESS OF THE GOOD CONDUCTOR.

Having already described the peculiar properties presented by four of the bronze alloys, viz., those of Sn 2Cu, Sn 3Cu, Sn 4Cu and Sn 5Cu, we should have nothing more to add to them, if we did not wish to illustrate the extraordinary influence which tin exercises on the conductibility of copper, and also to show that when there is a great excess of a good conductor in an alloy, it overcomes the resistance of the bad conductor, and in consequence the conductibility of such alloys increases with the proportion of the good conductor.

	Obtained.	Calculated	Silver = 1,000.	
			Obtained.	Calculated
Sn = 27·10 5Cu = 72·90	6·60	22·50	207	705
Sn = 15·68 10Cu = 84·32	9·80	23·90	307	749
Sn = 11·03 15Cu = 88·97	12·82	24·50	402	768
Sn = 8·51 20Cu = 91·49	14·85	24·81	465	778
Sn = 6·83 25Cu = 93·17	15·15	25·02	475	784

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[*] The surfaces in the vessels B and C of bar 9 being to our standard bar of copper 5 : 3·5 : : 26·95 : x=18·86.

[†] A metal having a very low conducting power.

ALLOYS OF BISMUTH AND ANTIMONY.

These alloys also show a gradually higher degree of conductibility as the number of equivalents of antimony increases in the compound.

	Obtained.	Calculated.	Silver = 1,000	
			Obtained.	Calculated.
Bi = 62·26 Sb = 37·74	1·97	3·52	62	110
Bi = 45·21 2Sb = 54·79	2·45	4·23	76	132
Bi = 35·48 3Sb = 64·52	2·55	4·63	80	145
Bi = 29·20 4Sb = 70·80	3·05	4·90	96	153
Bi = 24·81 5Sb = 75·19	3·45	5·08	108	159

ALLOYS OF ANTIMONY AND LEAD.

Owing no doubt to the slight difference of the conductibility of these two metals,

Antimony being	6·12
Lead	9·17

the influence of excess of equivalents of lead over those of antimony is not so striking in this series as in the preceding one. The following are the results observed:

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Sb = 38·39 2Pb = 61·61	6·05	8·00	190	251
Sb = 23·68 4Pb = 76·32	6·50	8·44	204	265
Sb = 17·20 6Pb = 82·80	7·05	8·64	221	271
Sb = 13·48 8Pb = 86·52	7·00	8·75	219	274
Sb = 11·08 10Pb = 88·92	7·35	8·83	230	276

ALLOYS OF ZINC AND COPPER.

The reason why we have kept these alloys all together, and have not divided them so as to bring them under the last two divisions, is, that they have a tendency to come entirely under the last division. We say a tendency, for they do not offer the distinctive degrees of conductibility that the alloys of copper and tin or bismuth and antimony present; but this may be due to the conducting powers of copper and zinc being within a few degrees of one another,

Cast Copper being	25·87
Cast Zinc	20·03

CONDUCTIBILITY OF COPPER AND ZINC ALLOYS.

	Obtained.	Calculated.	Silver = 1,000.	
			Obtained.	Calculated.
Cu = 49·32 Zn = 50·68	21·95	22·92	688	718
Cu = 32·74 2Zn = 67·26	13·65	21·91	428	687
Cu = 24·64 3Zn = 75·36	16·95	21·44	531	672
Cu = 19·57 4Zn = 80·43	18·80	21·14	589	663
Cu = 16·30 5Zn = 83·70	19·00	20·95	595	657

It is probable that Cu 2Zn and Cu 3Zn are definite compounds, for not only have they a special conducting power of their own far below that of the metals composing them, but also they are perfectly crystallized. The most splendid of all the brass alloys is the alloy Cu Zn, which is of a beautiful gold colour and crystallizes in prisms, often 3 centims. long. These crystals are also interesting on account of their extraordinary elasticity. It is surprising that so cheap an alloy has not been employed in commerce, for no commercial brass contains more than 30 to 35 per cent. of zinc, whilst the above one contains 50·68 of this metal. The only explanation that we can give of this fact is, that if copper be alloyed with more than 50 per cent. of zinc, the alloys formed do not possess the colour of brass, but become white as zinc, and therefore the manufacturers have never tried to unite these metals in the exact proportions given above. We say exact, for it is remarkable that a variation of a few per cent. in the relative proportions of the two metals no longer yields the beautiful alloy which we have noticed, but only a white and comparatively useless one.

ALLOYS WITH EXCESS OF COPPER.

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Zn = 33·94 2Cu = 66·06	19·80	23·80	621	748
Zn = 25·52 3Cu = 74·48	20·35	24·37	638	764
Zn = 20·44 4Cu = 79·56	21·25	24·67	666	770
Zn = 17·05 5Cu = 62·95	22·80	24·87	715	780

We also made a bar 1 centim. cub. square of zinc and copper, placing a cube of each metal alternately, as in No. 3 bar of tin and copper, and the result obtained is similar, for we have—

	Found.	Calculated.	Silver = 1,000.	
			Found.	Calculated.
Bar 10	22·5	23·33	705	731

The facts presented by a bar 1 centim. square, and composed of two longitudinal bars of copper and zinc, have been described under the bar No. 5.

We also thought that it might be useful if we were to analyse the following commercial alloys, and determine their respective conducting powers :—

	Found.	Calculated.	Silver = 1000,.	
			Found.	Calculated.
"Yellow brass." ... Cu = 64·0 Zn = 56·0	17·80	22·73	558	712
"Pumps and pipes" ... Cu = 80·0 Sn = 5·0 Zn = 7·5 Pb = 7·5	13·60	22·57	426	707
"Mud plugs" Cu = 80·0 Sn = 10·0 Zn = 10·0	12·60	24·00	394	764
"Large bearings ... ... Cu = 82·05 Sn = 12·82 Zn = 5·13	11·00	23·97	345	751

It is extraordinary to find what a low conducting power these alloys possess; for with the exception of the alloy named "Yellow brass," they do not conduct heat better than wrought and cast iron. This is due to the impurities of the metals employed, and shows the advantage that there will be in substituting for them some of the much cheaper alloys above described.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The twenty-ninth meeting of this Association commenced at Aberdeen, on Wednesday the 14th instant, under the Presidency of His Royal Highness the Prince Consort. The meeting has been well attended, and has been the largest in point of numbers of any hitherto held, with the exception perhaps of that at Newcastle. The number of applicants to join the Association was so great that on the Wednesday morning it became necessary to stop the issue of associate tickets—too great a crowd being apprehended at the meeting in the Music Hall in the evening, though that building was calculated to accommodate conveniently two thousand seven hundred persons. The hour fixed for the commencement of the proceedings was half-past seven, and nearly every seat was occupied immediately on the opening of the doors at seven o'clock. Professor Owen, the retiring President, in a short speech congratulated the Association on its prosperous condition, and then retired from the chair, which was taken by H. R. H. the Prince Consort, who proceeded to read his address, which occupied about forty minutes.

On Thursday morning, the 15th instant, the business of the sections commenced. The following papers were read:—

Section A.—Mathematical and Physical Science.

The Earl of Rosse, M.A., K.P., F.R.S., President.

1. Opening Address by the President.
2. Professor W. Thomson.—On the necessity for incessant Recording, and for simultaneous Observations in different localities, to investigate Atmospheric Electricity.
3. Professor Baden Powell.—Report on Luminous Meteors for 1858-9.
4. A. Cayley.—Provisional Report on the progress in the Solution of certain special problems in Dynamics.
5. John Thomas Towson.—Report on changes of Deviation of the Compass on board Iron Ships by "heeling;" with Experiments on board the "City of Baltimore," "Aphrodita," "Simla," and "Slieve Donard."
6. Fleeming Jenkin.—On the rapidity of Signalling through long Submarine Telegraphs; with remarks by Professor W. Thomson on the discharge of a coiled Electric Cable.

Section B.—Chemical Science.

Dr. Lyon Playfair, C B., F.R.S., &c., President.

1. Opening Address by the President.
2. Professor G. Wilson.—On the Stages which led to the Invention of the Modern Air-Pump.
3. Dr. J. H. Gladstone.—On the Fluorescence and Phosphorescence of some Diamonds.
4. Messrs. Versmann and Oppenheim.—On the Comparative Value of certain Salts for rendering Fibrous Substances Non-inflammable.
5. Dr. S. Macadam.—On the Analysis and Valuation of Manures.

Section C.—Geology.

Sir Charles Lyell, LL.D., D.C.L., F.R.S., &c., President.

1. Opening Address by the President.
2. Professor Nicol, F.R.S.E., F.G.S.—On the Geology of Aberdeenshire.
3. Rev. John Longmuir, A.M., LL.D.— On Coast Section between Aberdeen and Dunnottar Castle.
4. A. Geikie, F.G.S —On the Chronology of the Trap Rocks of Scotland.
5. H. C. Sorby, F.R.S.—On the Origin of Cone in Cone Structure.
6. Rev. H. Mitchell.—On New Fossils from Lower Old Red Sandstone of Scotland.
7. Thomas F. Jamieson.—On the Junction of Granite with Stratified Rocks.

Section D.—Zoology and Botany including Physiology.

Sir W. Jardine, Bart., F.R.S.E., President.

1. Opening Address of President.
2. Dr. Dickie.—On the Characteristic of the Aberdeenshire Flora.
3. Professor Allman.—On a New Genus of Lucernariadæ.
4. Mr. Gould.—On some new species of Birds.
5. Rev. W. S. Symonds.—On Drift Pebbles found in the Stomach of a Cow.
6. Mr. Beattie.—Short Account of a Bone Cave near Montrose.
7. Dr. M'Bain.—Notice of the Skull of a Wombat from the Bone Caves of Australia.
8. Dr. Ogilvie.—On the Vegetative Axis of Ferns.
9. Dr. Murray.—On a Species of Galago from Old Calabar.

Sub-Section D.—Physiology.

Dr. Sharpey, F.R.S., President.

1. Professor Bennett.—On the Structure of the Nerve Tubes.
2. Dr. Redfern.—On the Admixture of Nervous and Muscular Fibres in the nerve of the Leech.
3. Bernard E. Brodhurst, F.R.C.S.—On the Repair of Tendons after their Sub-cutaneous Division.
4. M. Foster, M.B.—On the Beat of the Snail's Heart.
5. G. H. Lewes.—On the necessity of a Reform in Nerve Physiology.

Section E.—Geography and Ethnology.

Admiral Sir James Clark Ross, D.C.L., F.R.S., President.

1. Professor Owen.—Report on the Crania of the Tribes of Nepaul.
2. Captain Sherard Osborn, R.N.—Geographical Remarks upon the Yangtse-Keang, with Observations upon its future Commerce.
3. John Craufurd, Esq., F.R.G.S.—On the Relation of the Domesticated Animals to Civilization.
4. John Hogg, F.R.S.—On Gebel Haurán—its adjacent Districts—and the Eastern Desert of Syria, with Remarks on their Geography and Geology.

Section F.—Economic Science and Statistics.

Colonel Sykes, F.R.S., M.P.—President.

1. The President.—Introductory Remarks.
2. John Strang, LL.D.—Church Building in Glasgow, shewing the number, size, and cost of the various places of Worship erected there during the last twenty years, through voluntary effort.
3. Dr. W. Moore, T.C.D., M.R.I.A.—Statistics of Small-Pox and Vaccination in the United Kingdom.
4. The Hon. Thomas M'Combie—Statistics of the Trade and Progress of the Colony of Victoria, Australia.

Section G.—Mechanical Science.

The Rev. Professor Willis, F.R.S., President.

1. Report of the Committee on Steam Ship Performance.
2. Admiral Moorsom.—On the Performance of Steam Vessels.
3. J. Oldham, C.E.—Report of the Progress of Steam Navigation at Hull.
4. Charles Atherton, communicated by H. Wright.—On Mercantile Steam Transport Economy, as affected by the consumption of Fuel.
5. J. Macquorne Rankine, LL.D.—A condensed Abstract of Experiments, by Messrs. R. Napier and Sons, on the Strength of Wrought Iron and Steel.

6. Donald Bain, communicated by H. Wright.—On Harbours of Refuge.

7. Vice-Admiral Moorsom.—On the Performance of Steam Vessels.

His Royal Highness, the President, visited each of the sections during the course of the morning. In the evening a Conversazione was held in the Music Hall. A large number of interesting objects were displayed for the inspection of the visitors. These consisted of a remarkable exhibition of historical portraits and objects of antiquity, as well as a fine collection of photographs, with microscopes, stereoscopes, &c.

On Friday morning, the 16th, the business of the sections was resumed, and the following is a list of the communications made:—

Section A.—Mathematical and Physical Science.

1. Sir William R. Hamilton.—On an application of Quaternions to the Geometry of Fresnel's Wave Surface.
2. Admiral Fitzroy.—On Aqueous Vapours and Atmospheric Waves.
3. Sir David Brewster.—On a New Species of Double Refraction.
4. J. B. Lindsay.—On the Transmission of Electricity through Water.
5. The Abbé Moigno.—On the Phonautograph for Registering Simple and Compound Sounds.
6. The Abbé Moigno.—Supplement to Newton's Method of Resolving Equations.
7. The Abbé Moigno.—Portable Apparatus for Analyzing Light, invented by M. Porro.
8. Colonel Sykes.—Report of the Balloon Committee.
9. J. Pope Hennessy.—On certain Properties of the Powers of Numbers.
10. A. Claudet.—On the Stereoscopic Angle.
11. A. Claudet.—On the Focus of Object Glasses.
12. A. Claudet.—On the Stereomonoscope.
13. A. Claudet.—On a changing Diaphragm for Double Achromatic Combinations.
14. H. R. Twining.—On the Angular Measurement of the Picture in Painting.

Section B.—Chemical Science.

1. Abbé Moigno.—New Process of Preserving Milk perfectly pure in the natural state, without any chemical agent.
2. Dr. Lyon Playfair.—On a symmetrical representation of Oxides and Salts on a common type.
3. The Master of the Mint.—On the Molecular Movements of Fluids.
4. Mr. Walter Crum.—On the ageing of Mordants in Calico Printing. Communicated by Professor G. Wilson, with Observations and Illustrations.
5. Mr. Brazier.—Laboratory Memoranda.
6. Mr. Crace Calvert.—On the formation of Rosolate of Lime on Cotton fabrics in Hot Climates.
7. Mr. Crace Calvert.—On the Density of Alloys.
8. Mr. G. B. Buckton.—On Stib-ethyl.

Section C.—Geology.

1. W. H. Baily, F.G.S., Paleontologist to the Irish Geological Society.—On Sphenoptoris Hookeri and Ichthyolites, from Kiltorkan Hill, Kilkenny.
2. Dr. Bryce, F.G.S.—Notice of the discovery of Upper Silurian Fossils in the Devonshire Slates.
3. Dr. Black, F.G.S.—On Coal at Ambisheg, Isle of Bute.
4. Rev. Dr. Anderson, F.G.S.—On Human Remains in Superficial Drift.
5. Rev. Dr. Longmuir.—On the Remains of the Cretaceous Formation in Aberdeenshire.
6. T. F. Jamieson.—On Drift Beds of the North of Scotland.
7. John Cleghorn.—On the Submerged Forests of Caithness.
8. William Pengelly, F.G.S.—On the Ossiferous Fissures of Oreston.
9. G. D. Gibb, A.M., M.D., F.G.S.—On Canadian Caverns.

Section D.—Zoology and Botany, including Physiology.

1. Professor Owen.—On the orders of the class Reptilia, and their distribution in time.
2. Dr. Dyce.—On the identity of Morrhua vulgaris and M. punctata, hitherto described as distinct species.
3. Dr. Dickie.—On the upper limits of Cultivation in Aberdeenshire.
4. Professor Allman.—On a remarkable form of Parasitism in Pycnogonidæ.
5. Dr. Bennet.—On the Vegetable Ivory Manufactures of Birmingham.
6. Dr. Lankester.—On the failure of bright-coloured Flowers in Forest Trees to produce effect unless accompanied by abundance of green leaves, by Dr. Buist.
7. Mr. Stainton.—On the Distribution of British Butterflies.
8. Sir William Jardine, Bart.—Notice of Syrrhaptis paradoxus, by Mr. John Moore.
9. Dr. Macbain.—Notice of the Skull of a Seal.
10. Dr. Macbain.—Notice of the Skull of a Manatee.
11. Dr. Macbain.—Notice of the duration of life in the Actinia Mesembryanthemum when kept in confinement.
12. Professor Macdonald.—On the Osteology of Lophius piscatorius.

Sub-Section D.—Physiology.

1. John Adamson, M.D.—Lactation in an unimpregnated Female of Canis familiaris.
2. Professor Allman.—Report on the Reproductive Organs of the Hydroid Zoophytes.
3. George Ogilvie, M.D.—The Genetic Sycle in Organic Nature.
4. Professor Laycock.—Handwriting and Drawing of the Insane—as illustrative of some modes of Cerebral Functions.
5. Professor Bennett.—On the Origin of Morbid Growths, with reference to the Connective Tissue theory.

Section E.—Geography and Ethnology.

1. Major Phillips.—On some curious Discoveries concerning the Settlement of the Seed of Abraham in Syria and Arabia.
2. Sir Andrew Leith Hay.—On the Vitrified Fort in Aberdeen.
3. Laurence Oliphant, F.R.G.S.—Notes on Japan.
4. John Craufurd.—On the Effects of the recent Gold Discoveries.
5. Professor Tennant.—Notes on a Nugget from Victoria, &c.
6. Hon. Thomas M'Combie.—On the Aboriginals of Australia.
7. Dr. M'Gowan.—On the native Inhabitants of Formosa.
8. Consul Petheric.—Exploration of the White Nile.
9. Captain Speke, R.N.—Discovery of Lake Nyanza in Central Africa.

Section F.—Economic Science and Statistics.

1. J. T. Mackenzie.—On the Trade and Commerce of India.

Section G.—Mathematical Science.

1. P. Le Neve Foster.—Report of the Patent Committee.
2. William Fairbairn, F.R.S.—On Experiments to determine the Efficiency of Continuous and Self-acting Breaks for Railway Trains.

3. J. F. Bateman, C.E., F.R.G.S.—Description of Glasgow Water Works.
4. R. Aytoun.—On a Safety Cage for Miners.
5. J. Abernethy, C.E.—On the rivers "Dee," forming the Ports of Aberdeen and Chester.

In the evening a general meeting of the Association took place in the Music Hall, to hear a discourse from Sir Roderick Murchison, the Director-General of the Geological Survey of the United Kingdom, upon the Geology of the Northern Highlands.

On Saturday, the 17th, the business before the Section was as follows:—

Section A.—Mathematical and Physical Science.

1. Rev. H. Lloyd.—On the Affections of Polarized Light reflected from and transmitted by thin plates.
2. Sir D. Brewster.—On a curious landscape inclosed in a piece of calcedony belonging to a lady, exhibited and explained.
3. The Astronomer Royal.—On the former and present position of the question of the secular acceleration of the Moon's motion.
4. Admiral Fitzroy.—On Atmospheric Waves.
5. The Abbé Moigno.—On a New Electro-medical Apparatus, by M. Ruhmkorff.
6. Abbé Moigno.—On Becquerel's Phosphoroscope.
7. J. P. Gassiot.—On the Stratified Electrical Discharge, as affected by a moveable glass ball.
8. J. P. Joule.—On Friction in Air.
9. B. Stewart.—On Radiant Heat.
10. Professor Maxwell.—On Mixture of the Colours of the Spectrum.
11. G. J. Stoney.—Note on the propagation of Waves.
12. Mungo Ponton.—On Chromatic Dispersion.
13. Mungo Ponton.—On Wave Lengths of different rays.
14. J. J. Walker.—On the Iris seen in Water.
15. Colonel Shortrede.—On Proportional Compasses.
16. Colonel Shortrede.—On calculating Lunars.
17. Thomas Sutton.—On a new Photographic Lens.
18. J. Smith.—On the Cause of Colour.

Section B.—Chemical Science.

1. Professor Maskelyne.—Report on the Chemical Characters of the Photographic Image.
2. Dr. Gladstone.—To exhibit a Photograph of Fluorescent Substances.
3. M. l'Abbé Moigno.—To exhibit Two Photo-Chemical Experiments by M. Niepce de St. Victor; and a Collection of Photographs in Charcoal and Metallic Powder, and Photographic Enamels.
4. MM. Isoard.—On a New Mode of generating illuminating Gas by means of Super-heated Steam and any Hydro-Carbon.
5. Dr. Phipson, of Paris.—Composition of a recently-formed Rock on the Coast of Flanders. Communicated by M. l'Abbé Moigno.
6. Dr. Phipson, of Paris.—Composition of the Shell of Cardium Edule (Common Cockle).
7. Dr. Sullivan.—Preliminary Report on the Solubility of Salts.
8. Mr. A. Gages.—First Report on Mechanico-Chemical Analysis of Rocks.
9. Professor Tennant.—On Gold Nuggets from South Australia.
10. Mr. J. M'Donnell.—On the Action of Air on Alkaline Arsenites.
11. Mr. T. Spencer.—On the Supply and Purification of Water.

Section C.—Geology.

1. Henry C. Hodge.—On the Origin of the Ossiferous Caves of the Plymouth Limestone, with deductions from the observed facts.
2. D. Page, F.G.S.—Report on the Exploration of the Upper Silurians of Lesmahago, in terms of the Association's grant to Mr. Slimon.
3. D. Page, F.G.S.—On some new Boreal Forms from the Pleistocene Deposits of Scotland.
4. Rev. Dr Longmuir.—On Restoration of Pterichthys.
5. Rev. W. S. Symonds, F.G.S.—On some Fishes and Tracks from the Passage Rocks, and from the Lower Old Red Sandstone of Herefordshire.
6. J. Miller, F.G.S.—On some New Fossils from the Old Red Sandstone of Caithness.
7. Professor Daubeny, F.R.S.—On certain Volcanic Rocks in Italy, which appear to have been subjected to Metamorphic action.
8. Dr. Macgowan.—On certain Phenomena attendant on Volcanic Eruptions and Earthquakes in China and Japan.
9. Messrs. Garner and Molyneux.—On the Coal-fields of Staffordshire.
10. Dr. Buist, F.G.S.—On the Geology of Lower Egypt.

Section D.—Zoology and Botany, including Physiology.

1. Dr. G. Wilson.—On the Employment of the Electrical Eel, Gymnotus Electricus, by the Natives of Surinam.
2. Dr. Bleeker.—On New Genera of Fish from Java.
3. Dr. Dickie.—On the Structure of the Shell of some Species of Pecten.
4. Dr. Dickie.—On the Flora of the Shores of Davis' Straits, by Mr. James Taylor.
5. Dr. Dickie.—Remarks on the Greenland and Iceland Falcons, by Mr. James Taylor.
6. Mr. C. W. Peach.—Catalogue of Zoophytes of Caithness, especially around Wick.
7. Mr. Croall.—Notes on Braemar Plants.
8. Mr. Yates.—On the Cones of Cycads.
9. Dr. Ogilvie.—Report of the Dublin Bay Dredging Committee.
10. Dr. Lankester.—Notice of an Infusorial deposit in the Island of Lewis.
11. Dr. Lankester.—The Growth of Trees in Continental and Insular Climates, by Daniel Vaughan.
12. Dr. Lankester.—Report on the Growth of Plants, by Professor Buckman.
13. Mr. Price.—On the Genus Cydippe.

Sub-Section D.—Physiology.—Did not meet this day.

Section E.—Geography and Ethnology.

1. Thomas Mitchell, Esq.—The Russian Trade in Central Asia.
2. The Rev. S. Hislop, F. C. Missionary.—On the Aboriginal Tribes of the Province of Nagpore, Central India.
3. Baron de Bode.—On the Country to the West of the Caspian Sea. Communicated by Dr. Hodgkin.
4. John Stuart, Sec. Soc. Ant. Scot.—On the Sculptured Stones of Scotland.
5. Colonel Jonathan Forbes, A.M.—On the Ethnology and Hieroglyphics of the Caledonians.
6. J. Lyons M'Leod, F.R.G.S.—Notes on the Geography of Eastern Africa, communicated by Sir R. I. Murchison.
7. John Hogg, F.R.S.—On the Karaite Jews.
8. R. Cull, F.R.S.—To exhibit Two Axe Heads brought by P. O. Callaghan, Hon. Sec. Leeds Philosophical Society.

Section F.—Economic Science and Statistics.

1. Alexander Thomson, of Banchory.—On the Aberdeen Industrial Feeding Schools.
2. John Craufurd, F.R.S.—On the Effects of the Influx of the Precious Metals which followed the Discovery of America.

3. Henry Fawcett, M.A., F. Trin. Hall, Cambridge.—On the Social and Economical influence of the New Gold.

4. Ar. Harvey.—On the Statistics of Agriculture of Aberdeenshire.

5. G. B. Bothwell.—On the Manufactures and Trades of Aberdeen.

Section G.—Mechanical Science.

1. J. F. Bateman.—On the Result of Boring for Water in the New Red Sandstone near Shiffnall, in the County of Salop.

2. W. Robertson, communicated by Peter Spence.—On a Patent Chain Propeller.

3. Admiral Paris, C.B.—On the Manœuvring of Screw Vessels.

4. Arthur Taylor, communicated by H. Wright.—On the True Action of what are called Heat Diffusers.

5. A. Batten.—On a Boat-Lowering Apparatus.

6. E. A. Wood.—On a Mode of Suspending, Disconnecting, and Hoisting Boats attached to Sailing Ships and Steamers at Sea.

7. D. K. Clark, C.E., communicated by H. Wright.—On Smokeless Coal-burning Locomotive Engines.

On Monday the 19th, the Sections resumed their business, when the following papers were read :—

Section A.—Mathematical and Physical Science.

1. H. A. S. Smith.—Report on the Theory of Numbers.

2. G. J. Symons.—Report on Thunder Storms.

3. Professor Tyndall.—On the Establishment of Thermometric Stations on Mont Blanc.

4. Sir D. Brewster.—On the connexion between the Solar Spots and Magnetic Disturbances.

5. Professor Lindelöf.—On the Calculus of Variations.

6. W. De la Rue.—On Celestial Photography.

7. H. Cox.—On the Submergence of Telegraphic Cables.

8. Professor W. Thomson.—On Electrical "Frequency."

9. Fleeming Jenkin.—On Gutta Percha as an Insulator at various temperatures.

10. Sir D. Brewster.—On Sir Christopher Wren's Cypher containing Three Methods of finding the Longitude.

11. C. F. Varley.—On Methods of Finding the Position of a Fault in a Submarine Cable.

12. J. Park Harrison.—On Lunar Influence on Temperature.

13. A. Cruickshank.—On the Transparency of the Atmosphere.

14. Rev. T. Rankin.—Meteorological Observations.

Section B.—Chemical Science.

1. Dr. Odling.—On a New Mode of Bread-making.

2. Drs. Odling and Dupré.—On the Composition of Thames Water.

3. Mr. G. C. Foster.—Report on the Recent Progress and Present State of Organic Chemistry.

4. Notice of Dugong Oil.—Communicated by Mr. Brazier.

5. Mr. Binney.—On the Solubility of Bone-earth from various sources in solutions of Chloride of Ammonium and common Salt.

6. Professor Voelcker.—Report on Field Experiments on the essential Manuring Constituents of Cultivated Crops.

Section C.—Geology.

1. C. Moore, F.G.S.—On Brachiopoda, and on the development of the loop in Terebratella.

2. Dr. Dawson, F.G.S.—A letter to Sir Charles Lyell on the occurrence of a Land Shell and Reptiles in the South Joggins Coal-field, Nova Scotia.

3. Professor Nicol, F.S.S.E.—On the Relations of the Gneiss, Red Sandstone, and Quartzite in the North West Highlands.

4. Professor Huxley, F.R.S.—On the newly discovered Reptilian remains from the neighbourhood of Elgin.

5. Professor Harkness.—On the Yellow Sandstones of Elgin and Lossiemouth.

6. J. Miller.—On the age of the Reptile Sandstone of Morayshire.

7. C. Moore, F.G.S.—On the Supposed Wealden and other beds near Elgin.

8. Rev. Dr. Anderson, F.G.S.—On Dura Den Sandstone.

Section D.—Zoology and Botany, including Physiology.

1. Mr. F. Jamieson.—List of the Birds of the North of Scotland, with their Distribution.

2. Dr. Lankester.—Description of New Species of Polyzoa and Echinodermata from Shetland.

3. A. Murray.—On the Disguises of Nature, with Illustrations.

4. Dr. Dickie.—On the Mollusca of Aberdeenshire.

5. Mr. Gould.—On Birds of Paradise.

6. Professor Allman.—On certain Forms of Marine Invertebrata, obtained by some recent dredging in the Orkney Seas.

7. Dr. Lankester.—Exhibition of Drawings of British Spiders.

8. Mr. Hogg.—Account of a Species of Phalangista, recently shot in the County of Durham.

9. Dr. MacGowan.—Remarks on the Cultivation of the Opium Poppy of China.

10. Dr. Redfern.—On the Structure of the Otolites of of the Cod (Gadus Morrhua).

11. Dr. Redfern.—Note on the Method of Production of Sound by a species of Notonecta.

12. Mr. Peach.—Notes on different subjects in Natural History, illustrated by specimens.

Sub-Section D.—Physiology.

1. Robert Garner, F.L.S.—Reproduction in Gasteropoda, and on some curious Effects in Endosmosis.

2. William Marcet, M.D., F.R.S.—An Experimental Inquiry into the action of Alcohol on the Nervous System.

3. Professor Bennett.—On the Molecular Theory of Organisation.

4. W. C. E. Nourse, F.R.C.S.—On the Organs of the Senses, and on the Mental Perceptive Faculties.

5. A. B. Garrod, M.D., F.R.S.—On the Specific, Chemical, and Microscopical Phenomena of Gouty Inflammation.

6. G. H. Lewes.—On the supposed distinction between Sensory and Motor Nerves.

Section E.—Geography and Ethnology.

1. Major J. Stokes, R.E.—Notes on the Lower Danube.

2. Consul Dalyell.—Memorandum of Earthquake at Erzerum.

3. Consul S. Freeman.—Description of Ghadamès. Communicated by the Earl of Ripon.

4. Dr. Kirk, M.D., and Captain Bedingfield.—Notes from the Zambesi Expedition under Dr. Livingston. Communicated by Dr. Shaw.

5. Dr. Hector.—Description of Passes through the Rocky Mountains. Communicated by Sir R. I. Murchison.

6. Major Synge, R.E.—Rapid communication between the Atlantic and the Pacific, *via* British North America.

7. Dr. Norton Shaw.—Notes on the proposed Railway communications between the Atlantic and Pacific Oceans, *via* the United States of America.

8. William Bollaert, F.R.G.S.—On the Geography of Southern Peru.

Section F.—Economic Science and Statistics.

1. J. Pope Hennessy.—Results of the Society of Arts' Examinations.

2. Professor George Wilson, M.D.—Some Statistics on Colour-blindness.

3. The President.—The Past, Present, and Prospective Financial Condition of British India.

Section G.—Mechanical Science.

1. Abbé Moigno.—On a new Gas-burner.

2. Abbé Moigno.—On an Automatic Injector for feeding boilers, by Mr. Giffard.

3. Abbé Moigno.—On a Heliço-meter, an instrument for measuring the thrust of the Screw-propeller.

4. Abbé Moigno.—On an application of the moving power arising from tides to manufacturing, agricultural, and other purposes; and specially to obviate the Thames nuisance.

5. Alexander Gibb.—Description of the Granite Quarries of Kincardineshire.

6. { Alexander Allan.—On Gas Meters.
Alexander Allan.—Description of an Improved method of obtaining a true Liquid Level.

7. John Robb.—On the comparative Value of Propellers.

8. Alexander Gerard.—An experimental illustration of the Gyroscope.

At three o'clock the General Committee met, when it was unanimously resolved that the next meeting of this Association be held at Oxford, under the presidency of Lord Wrottesley.

Invitations were received from Cambridge, Manchester (for 1861), and Birmingham.

General Sabine, who has been General Secretary to the Association for twenty years, resigned his office, and Professor Walker, of Oxford, was elected in his place.

In the evening a general meeting was held in the Music Hall, at half-past eight, to hear the discourse of Dr. Robinson, Director of the Armagh Observatory, "On Electrical Discharges in highly-rarified Media." The discourse was illustrated by a series of very beautiful experiments, performed with the assistance of Mr. Gassiot and Mr. Ladd.

Tuesday, 20th September.—The sections met this morning, and proceeded with their business. The following papers were read:—

Section A.—Mathematical and Physical Science.

1. Dr. Lee.—On three Variable Stars, R. and S. Ursae Majoris and U. Geminorum, as observed consecutively for six years by Mr. Pogson.

2. N. Pogson.—On an improvement in the Heliometer.

3. Professor J. Thomson.—On recent Theories and Experiments on Ice at its melting point.

4. W. R. Birt.—On the Mid-day Illumination of three Lunar Craters.

5. J. B. Lindsay.—On Chinese Astronomy.

6. Sir David Brewster.—On the decomposed glass found at Nineveh and other places.

7. Sir David Brewster.—On the Fall of Rain in Forfarshire.

8. Rev. J. C. Clouston.—On the Climate of Orkney.

9. M. P. Sandeman.—On Meteorology of British Guiana.

10. Professor Hennessy.—On Mild Winters in the British Isles.

11. Astronomer Broun.—On the Annual Variation of the Barometer.

12. G. F. Harrington.—On the Theory of Light.

13. G. V. Towler.—On the Cause of Magnetism.

14. T. Davies.—On the Diurnal Variation of the Barometer.

15. C. Willich.—On the Angles of Dock Gates, and the Cells of Bees.

16. R. Campbell.—On the Probability of Uniformity in Statistical Returns.

17. A. S. Wilson.—On a System of Moving Bodies.

18. Sir C. Grey.—On the Longitude.

19. James Smith.—On the Relations of a Circle inscribed in a Square.

Section B.—Chemical Science.

1. Mr. F. Ransome.—On Soluble Silicates, and some of their applications.

2. Mr. T. Segelcke.—Notes on the Current Methods for estimating Cellulose, or "Woody Fibre," in Vegetable Food-stuffs.

3. Messrs. Lawes and Gilbert.—On the Effects of different Manures on the Composition of the Mixed Herbage of Meadow Land.

4. Dr. Macvicar.—On the Organic Elements and their relations to each other and to the medium of light, illustrated by Models according to the Author's theory of the forms and structures of the Molecules of Bodies.

5. Dr. Dalzell.—On Crystallized Bi-chromate of Strontia.

6. Dr. Dalzell.—On the Economical preparation of pure Chromic Acid.

7. M. L'Abbé Moigno.—On Corne and Demeaux's disinfecting and deodorizing Powder.

8. M. L'Abbé Moigno.—On Matches without Phosphorus or Poison.

9. M. L'Abbé Moigno.—To exhibit a Nephogene, capable of being adapted to many chemical, therapeutic, and hygienic purposes.

10. Dr. Wallace.—On the Equivalent of Bromine.

11. Dr. Wallace.—On proposed Improvements in the Manufacture of Kelp.

12. Dr. Daubeny exhibited Specimens of several varieties of Volcano Tuff, from the neighbourhood of Rome and Naples.

13. Dr. Guthrie.—Reports from the laboratory at Marburg.

14. Mr. Napier.—New process of etching glass in relief, by hydrofluoric acid. Communicated by Professor Wilson.

Section C.—Geology.

1. Rev. Professor Sedgwick, F.R.S.—On Faults in Cumberland and Lancashire.

2. Professor Rogers, F.R.S.—On some observations on the Parallel Roads of Glenroy.

3. D. Page, F.G.S.—On the Structure, Affinities, and Geological range of Eurypteridœ.

4. Professor Harkness, F.R.S.—On Sections along the Southern flanks of the Grampians.

5. J. Wyllie.—On some Old Red Sandstone Fossils.

6. C. W. Peach.—On New Fossil Fish from Caithness.

7. W. H. Baily, F.G.S.—On Tertiary Fossils of India.

Section D.—Zoology and Botany, including Physiology.

1. Mr. Peach.—Exhibition of Objects of Natural History.

2. The Rev. W. S. Symonds.—On the Fish Rain of Aberdare, Glamorganshire.

3. Dr. Adams.—On the birds of the District of Banchory.

4. Mr. Price.—On the Genus Cydippe.

5. T. M. Masters, Esq.—On the Vegetable Morphology.

6. Mr. Nourse.—On the Colours of Leaves and Plants.

7. Mr. Lowe.—On the Temperature of Flowers.

8. Mr. Nourse.—On the Habits and Instincts of the Chameleon.

9. Mr. S. M. Burnett.—Personal Observations on the Zoology of Aberdeenshire.

10. Dr. Buist.—On the Aversion of Certain Plants to each other's neighbourhood.

11. Dr. Buist.—On the Bombaceæ of Western India.

12. Dr. Dickie.—Report of the Belfast Dredging Committee.

Sub-Section D.—Physiology.

1. G. H. Lewes.—A Demonstration of the Muscular Sense.

2. George Rainey, M.R.C.S.—On the Structure and Mode of Formation of Starch Granules, according to the principle of Molecular Coalescence.

3. John Denis Macdonald, R.N., F.R.S.—On the Homologies of the Coats of Tunicata, with Remarks on the Physiology of the Pallial Sinus System of Brachiopoda.

4. Richard Fowler, M.D., F.R.S.—A second Physiological attempt to unravel the perplexities of the Hypothesis of Berkeley.

5. Edward Smith, M.D., LL.B.—On the Sequence observed in the Phenomena observed in Man under the Influence of Alcohol.

6. Alphonse Gages, M.R.S.A.—On the comparative action of Hydrocyanic Acid on Albumen and Caseine.

7. William Camps, M.D.—On Certain Subjective Sensations, with especial reference to the Phenomena of Second Sight, Visions, and Apparitions.

8. William Camps, M.D.—On certain imperfectly recognised functions of the Optic Thealami.

Section E.—Geography and Ethnology.

1. Colonel James, R.E.—On his Geometrical Projection of Two-thirds of the Sphere, and its application to the representation of the Stars.

2. Colonel James, R.E.—On the Roman Camp at Ardoch, and the Military Works near it.

3. Captain Speke.—On the Commercial Resources of Zanzibar on the East Coast of Africa.

4. J. Barnard Davies, F.S.A.—On the Native Inhabitants of the Taraï of the Sub-Himalaya.

5. Mr. Antonius Ameuney (a Syrian).—On the Arabic speaking population of the World.

6. Dr. M'Gowan.—Chinese Genealogical Tables.

7. Admiral Fitzroy.—On Meteorology, with reference to Travelling, and the Measurement of the Height of Mountains.

8. Dr. W. Camps.—On the Laws of Consanguinity and Descent of the Iroquois.

Section F.—Economic Science and Statistics.

1. Sir John S. Forbes, Bart.—On Popular Investments.

2 Dr. Macgowan.—On the Trade Currency of China (with specimens of the coinage).

3. Colonel Shortrede.—On Decimal Coinage.

4. J. Valentine.—Notes on the Vital and Economic Statistics of Aberdeen.

5. R. Valpy.—On the British Trade with India. Communicated by E. Macrory.

6. Rev. W. Caine, A.M.—On the Progress of Public Opinion, with respect to the evils produced by the Traffic in Intoxicating Drink, as at present regulated by law.

7. Col. Sir J. Alexander.—On the Arts of Camp Life.

8. J. Valentine.—Notes on Illegitimacy in the City of Aberdeen compared with the principal Towns in Scotland.

9. J. Pope Hennessy.—On some Questions relating to the Incidence of Taxation.

10. R. L. Johnson.—On Decimal Coinage.

11. C. W. Peach.—Statistics of the Whale Fishery at Peterhead.

Section G.—Mechanical Science.

1.—William Fairbairn.—Experimental researches to determine the density of Steam at various temperatures.

2. J. Elder.—On the Steam Machinery of the Callao, Bogota, and Lima.

3. J. P. Joule, LL.D., F.R.S.—On Surface Condensation.

4. Mr. Rettie.—On a Submarine Lamp.

5. G. Johnstone Stoney.—On the advantages of the 40-inch Metre as a Measure of Length.

6. Andrew Henderson.—On India River Steamers and Tow-boats—giving an account of their improved construction for light draft, capability for cargo, and fittings, conducive to manageability in shallow rapid rivers, &c., and of the practical value of the Dynamometer in showing the resistance of vessels in tow, at different speeds and loads, with the result of test-trials made in England.

7. G. Hart.—On Gas Carriages for Lighting Railway Carriages with coal instead of oil.

8. Captain J. Addison.—On Coal-pit Accidents,

9. H. Johnson.—On a deep-sea Pressure Gauge.

10. Mr. Davies, F.R.S.A., F.L.S.—On a Patent Dix Pan for evaporating Saccharine solutions and other liquids at a low temperature.

11. Adam Topp will describe various Modes of Fire Escapes, Boats, &c.

Most of the sections concluded their business this morning, and do not meet any more.

In the course of the morning, after the business of the sections was over, a large party visited the Rubislaw Granite Quarries, and had the gratification of witnessing the operation of blasting, Messrs. Gibb and Son, the proprietors of the quarries, having kindly made special arrangements for the purpose. Three blasts took place, and all were successful.

In the evening a Conversazione was held at the Music Hall, which was well attended. The electrical experiments, illustrating Dr. Robinson's discoveries of the previous evening, were repeated.

Excursions took place during the week to Benachie, to the vitrified fort on the Tap o'Noth, to Banff, and to Elgin, also to Stonehaven and Dunnottar Castle.

The following manufactories were open to members on producing their tickets:—Messrs. Jas. Abernethy, Ironfoundry; Messrs. Catto, Thompson, and Co., Rope and Iron Wire Work; Messrs. Alex. Duthie and Co., Shipbuilding; Messrs. J. Gibb and Son, Granite Quarries; Messrs. J. Hall and Son, Shipbuilding; Messrs. Walter Hood and Co., ditto; Mr. Wm. Keith, Jun., Enamelled Slate and Polished Granite Works; Messrs. Macdonald, Polished Granite Works; Messrs. M'Kinnon and Co., Iron Foundry; Messrs. John Moir and Sons, Preserved Provision Works; Messrs. Al. Pirie and Sons, Paper Works; Messrs. Robinson, Crum, and Co., Cotton Mill; Messrs. Stewart R. Stewart and Co., Comb Work; Messrs. Thomson, Hall, Catto, and Co., Engineering Works; Mr. James Wright, Polished Granite and Marble Works.

REFORM IN THE PATENT LAWS.

In Section G of the British Association at Aberdeen, the following Report of the Committee on the Patent Laws was read:—

At the meeting of the British Association at Leeds, for the year 1858, a committee was reappointed for the purpose of taking such steps as may be necessary to render the Patent System of this country, and the funds derived from inventors, more efficient and available for the reward of meritorious inventors and the advancement of science.

Circumstances beyond control have prevented that committee from taking any decisive steps in furtherance of the important objects entrusted to them; but those objects have not been lost sight of. No reply has been received from the Commissioners of Patents, either to the memorial of the Glasgow Committee of the British Association, or of the Public Meeting in Manchester; but some of the questions referred to in those memorials are adverted to in the Report of the Commissioners just issued. From that report, it appears that the number of applications for Patents may be estimated at about 3000 per annum—that of these 3000 applications, not more than about two thousand proceed to the final stage of a Patent; and that of the two thousand Patents granted not more than 550 are kept alive beyond three years by the first periodical payment of £50 before the expiration of that term; and the Commissioners anticipate that the fee of £100, payable at the end of the 7th year, will not be paid on more than 100 of the surviving 550 patents. Should this anticipation prove correct, the payment by inventors in fees upon patents not surviving beyond one-half their term of 14 years, will not be less than at the rate of £100,000 per annum, as a direct tax on the inventive genius of the country in addition to, and exclusive of time, labour, and other charges and expenses. The total outlay in respect of those patents may be estimated as at least £250,000, or a quarter of a million per annum. The great work of printing and publishing *in extenso* the Specifications of Patents, granted under the old law—that is, from 1711 to the 1st October 1852, in number 12,977—is completed, and the surplus funds hitherto absorbed by this object will be henceforth available for other purposes. That surplus is estimated by the Commissioners at £30,000 for the current year, 1858-9, and to increase in each succeeding year at the rate of £20,000 per annum. This surplus, after providing for the current expenses, is proposed by the Commissioners to be appropriated to the following objects:—

1. The erection of a museum for the preservation and exhibition of models, of which a considerable collection already exists at Kensington.

2. The erection of suitable offices for the Commissioners, including a free library of consultation, upon a more extended scale than already formed by Mr. Woodcroft.

These most desirable and legitimate objects for the application of the "Inventors' Fee Fund," cannot however be attained without the sanction of the Lords Commissioners of Her Majesty's Treasury and a vote of Parliament, inasmuch as all the fees levied on inventors are, by a recent change, levied in the shape of stamps, and so pass directly into the Consolidated Fund. These recommendations of the Commissioners will, it is conceived, be regarded as a most legitimate application of the funds of Inventors, and as one to which the Parliamentary Committee of the British Association will give their aid, but your committee think that other considerations and other claims upon the Inventors' Fee Fund, and upon the annual surplus, whatever its probable amount, should be forthwith urged upon the Commissioners and upon Parliament.

The report of the Patent Committee of the British Association to the Leeds Meeting called prominent attention to the two following questions:—

1st. Whether the present scale of payment would be maintained or reduced so as to leave no greater surplus than necessary for official expenses?

2d. If the present scale of payment be maintained, how shall the surplus be appropriated?

The Commissioners of Patents are in favour of maintaining the present scale of payments, on the ground "that any material reduction in the amount of fees, would undoubtedly tend to increase the number of useless and speculative patents, in many cases taken merely for advertising purposes."

Your committee are not insensible to the force of this observation, but they beg respectfully to doubt whether this money check has any effective operation on the class of cases most requiring to be controlled, and whether the remedy is not worse than the disease in laying an unjustifiable burden on the inventive genius of the country, and effecting confiscation of property of its own creation.

Your committee are much struck with the fact that the application for about 1,000 patents is not prosecuted to completion, and in many cases probably not beyond the first stage; and that the first periodical payment of £50 at the end of the third year is not made in respect of nearly 1500 of the 2000 patents granted; and that the Commissioners anticipated during the ensuing year the surrender or lapsing of no less than 450 out of the 550 patents which survived the first periodical payment.

It must be borne in mind that the granting of patents in this country is practically without control, no attempt having been made to interpose any of the checks urged before the Committee of the House of Lords, in the session of 1851, and provided for in the three Bills of that session, and in the leet of the subsequent session, now the law of the land. The payment of £5 on the first application may be regarded as a registration fee; the applicant makes this payment on lodging the papers, obtaining protection and inchoate rights from the moment of his application. This was one of the cardinal features of the new system of 1852. It has been productive of the greatest benefit to invention, especially to those of the poorer class, by enabling them to obtain inchoate rights, and to create property for themselves by a simple record of their inventions without publicity and the obstruction of interested opponents. This power of placing inventions on record is also resorted to in many cases by those who do not wish further to secure or appropriate to themselves property in their ideas and inventions, which forthwith become public property. The 1500 lapsed patents must be regarded in a different light. These have cost their authors no less than £37,500 for fees and stamps as a direct taxation on their inventive genius, in addition to, and exclusive of, other payments of at least an equal amount. Of these 1500 patents it is believed that the progress of at least 1,000 might be arrested with the *consent* of the applicants if the inquiry before the law-officers were substantial instead of merely nominal. Thus a large useless outlay of capital in money and time would be avoided—talents unprofitably employed would be directed into other channels, and the creation of legal rights would be limited and reduced, exactly in proportion as the applications were not proceeded with.

Your Committee conceive that the application of a portion of the funds contributed by inventors would be most properly applied to affording them this species of protection against the unprofitable expenditure of time and money; the attempt is surely worth the trial; it would effectually check the prostitution of the patent system to the ilegitimate purposes referred to by the Commissioners.

The reward of the meritorious inventor, in cases in which he alone of the public has failed to benefit by the fruits of his genius and the purchase of patent rights in him of extending their terms, was referred to in the Report of the Patent Committee of the British Association at the Leeds Meeting, as a legitimate appropriation of a portion of the surplus.

These objects being satisfied, a very large surplus would remain available for the advancement of science, by researches having a direct bearing on the reproductive industry of the country. And if it be thought expedient that more money should be levied on the granting of patents than necessary for the expense of the office, inventors have, it is conceived, an irresistible claim for the expenditure of that surplus upon objects bearing on their interests and the advancement of science.

W. FAIRBAIRN.
EDWARD SABINE.
THOMAS WEBSTER.

Aberdeen, 16th September, 1859.

A discussion then ensued.

Mr. W. Fairbairn, F.R.S., V.P., laid before the meeting the Memorial of the Manchester Meeting, and expressed his concurrence in the suggestion for the reduction in the cost of patents, or, at all events, that any surplus should be rigidly applied to objects in which inventors have an interest.

Mr. R. Roberts—The suggestion as to the cost of a patent being limited to £25 was a delusion; the cost was more nearly £125. No patent ever paid under seven years, and very few under ten years. He did not see why inventors were to be subject to such an infliction or penalty for doing good to their country. If the object was to obstruct improvements, the legislature adopted the most efficient means for that purpose. No committee was competent, even if honest, to have the rejection of inventions entrusted to them. He would let inventors have patents at their pleasure, and leave it to litigation or natural death to remove them out of the way.

The Right Hon. Joseph Napier suggested that a copy of the Report should be sent to the Social Science Association, about to meet at Bradford, and that the requisite improvements in legal proceedings for the protection of the interests of patentees should be the subject of a paper, which he would be happy to support. He had always disapproved of the proceedings before the law officers. He felt ashamed, when a law officer, of having to discharge, without assistance, the duties which they were supposed to discharge, but which was only a mode of paying the law officers.

Professor Willis, F.R.S.—One difficulty was, that many persons in perfect honesty reinvented and reproduced inventions which had been tried and failed. Inventors wanted protection against themselves and their own inexperience. They had not the means of knowing what had been done; this opportunity ought to be afforded them; they were entitled to have that information afforded them. They were also entitled to have protection against others who lay in wait, making slight alterations, such as would suggest themselves to any person, and obtained patents for their so-called inventions, which they used for obstruction. Inventors ought not to be taken by surprise, and prevented, when their means were exhausted, from reaping the fruits of their inventions. They were entitled to be protected against themselves and the unfair dealings of others.

At the close of the discussion it was resolved unanimously:—

"That the Committee on the Patent Laws be re-appointed, for the furtherance of the objects set forth in their Report, presented to the Association at this meeting."

DEATH OF PROFESSOR HENFREY.

Professor Henfrey, F.R.S. and F.L.S., Examiner in Botany to the Society of Arts, a Member of the Council of the Horticultural Society, Professor of Botany in King's College, London, and Examiner in Natural Science to the Royal Military Academy, died, at his house at Turnham Green, on the 7th instant.

DRY CLAY BRICK AND TILE MACHINERY.

At the Royal Agricultural Society's show at Warwick, there was exhibited by Mr. H. Chamberlain, a machine patented by Messrs. Bradley and Craven, by means of which bricks, it is said, can be made from perfectly dry clay, so that when moulded, they can be taken direct to the kiln to be burnt. Mr. Chamberlain writes thus concerning it:—

"In introducing this system of brick and tile manufacture, which is no doubt novel to many readers, I must make a few remarks on the advantages they offer over the old plan. Brick-making has been hitherto carried on during a limited season of some six months in each year, or during the long days, as the bricks could not be dried in the winter, and frost would totally destroy them. The result of such a system presses very hard upon the brick labourer, who only finds full employment for one-half his time. Again, a large stock of bricks is obliged to be made, to meet the demands for the winter months, and if trade is not very flourishing the manufacturer has to hold them, or sell them at a great sacrifice. On the other hand, it often occurs that works are seriously delayed in the spring, from the make of the previous year being exhausted, and no further supply can be obtained until the new bricks of the current season are ready for use. The dry clay machines meet these emergencies, for all they require is a shed in which the clay may be stored as it is raised from the earth, a machine house, and kilns. If the clay-shed holds sufficient material for a month or six weeks' consumption, the works can be kept on uninterruptedly during the whole year, giving constant employment to the labourer, and enabling the manufacturer to meet any demand. In districts of the country where coals are cheap the bricks are dried on flues throughout the winter; or where my improved brickworks are erected, they are dried both in winter and summer, by the waste heat of the burning kilns. In the use of flues the consumption of fuel is considerable for this purpose, and therefore greatly increases the cost of manufacture. The saving of labour in making the bricks of dry clay is immense. When made in a plastic state, the clay must be tempered and worked, at great labour, into a perfectly homogeneous mass, and after manufacturing the bricks they have to be spread on drying-floors, or walled on drying-ground, to evaporate the water that it has taken so much trouble to thoroughly mix and work into it. As the drying ground for a large work is necessarily extensive, the labour of the several removals must entail a costly process, while on the dry clay making nothing more is necessary than to throw the rough earth into the machine, when it is delivered out a perfect brick for removal to the kiln at once for burning. The difficulties that arose during the first trials of this system were several, and many expensive experiments were carefully conducted before the machines were sufficiently perfect to introduce to the public. The first serious drawback was the difficulty of expelling the whole of the air from the clay, as the latter made a perfectly tight joint round the pistons before the whole of it was expelled, and the result on its release from pressure was a series of laminated cracks on the face of the brick, caused by the expansion of the air on being released from pressure. This is now entirely mastered in these machines. Another difficulty also presented itself, viz. that a machine which would make a perfect brick from a strong plastic clay if quite dry and very fine sifted, was quite useless if the clay was damp. The machines I now introduce have overcome these defects, and will work equally well with clay dry or damp, coarse or finely sifted. In practice it is found advisable with strong clays to use a portion of sand with the earth, the same as in plastic clay manufacture. The pressure can be regulated to anything desired, so that bricks can be made of the densest description for engineering purposes, or they may be made of as open a texture as the hand-made brick, by giving less pressure, and the addition of sand to the clay.

"For fire-brick making these machines are particularly adapted, and in case of existing works that have proper grinding mills, the machine only is necessary."

Proceedings of Institutions.

Birmingham (Messrs. Chance's) Library and Reading Rooms.—The last report states that the members have increased considerably, the average number per quarter for 1858 being 209, whilst in 1857 it was only 174, giving an increase of 35 members per quarter. Although this shows a satisfactory progress, as compared with some former reports, the committee desire to remind the friends of the Institution that in 1856 the average was 228. The reading-room is now attended more regularly and numerously than at any former period. The library has been increased within the year by the purchase of 120 additional volumes. The average issue of books has increased from 10 to 15 per day. The balance of £24, left in the hands of the committee at the close of the last year, was to be devoted to the further improvement and enlargement of the library. Three lectures have been delivered, one by the Rev. B. Willmore, on "The Wooden Walls of Old England;" one by Sebastian Evans, Esq., on "John Milton—his Life and Times;" and the third and last by Henry Chance, Esq., on "John Howard, the Philanthropist." The attendance upon each occasion was considerably above the average of that of former years. The committee draw particular attention in this report to the advantages of the Society of Arts' Examinations, and urge upon the members the importance of availing themselves of them. This appeal has been to some extent responded to, as is shown by the reports of the Examinations held in May last.

Bradford Mechanics' Institute. — The twenty-seventh annual report of the Bradford Mechanics' Institution shows that the number of the various classes of subscribers on the 31st of March last was as follows:—Life members, 128; members at 12s. per annum, 442; subscribers at 10s., 158; subscribers at 8s., 338; female subscribers at 6s., 39; firms, 11; persons nominated by firms, 87—Total, 1203. The total number on the books at the corresponding period of the previous year was 1240, which gives a decrease on the present year of 37. The cash account of the treasurer is less satisfactory than that of the preceding year, the receipts from subscriptions having fallen short by £41 5s. 5d. of the amount derived from this source in the previous year. This unfavourable result, however, is almost entirely confined to the first two quarters of the year; and, to a great extent, may be accounted for by the depression in trade which at that time prevailed, and the great lack of interest in news relating to political and public affairs. The gross receipts of the year, exclusive of a balance of £70 19s. 2d. from the previous year's accounts, have been £662 8s.; while the expenditure has amounted to £703 6s. 10d., giving an excess of expenditure over income of £40 18s. 10d. This result is chargeable to the payment of upwards of £51 for printing the new catalogue; and as the receipts from the sale of catalogues have as yet scarcely amounted to £20, the difference between these sums may be considered available as income in the ensuing year. In addition to this, a cash balance of £30 0s. 4d. is still remaining in the bankers' hands. The circulation of books from the library attests the high estimation in which this department is held by the members. During the 293 days the library has been opened, the number of volumes issued has amounted to 30,359, or an average of 103·180 per day. Although a large proportion, fully one-third, of this number comes under the classification of fiction, a considerable use has also been made of the more solid and useful books with which the library is plenteously supplied. It must be remembered, in estimating the value of this department, that the majority of those who avail themselves of its privileges are thus making their first acquaintance with the world of letters; and that their principal inducement has been to vary and relieve the ordinary avocations of daily life. The Committee refer with much pleasure to the new catalogue, published in September last, which in all respects is very greatly superior to the one previously in use. The number of volumes added during the year has been, by purchase, 180; by bound periodicals, 45; by donations 10;—total, 235. In addition to these, 49 volumes have been purchased to supply worn out books. The total number of volumes at present in the library, including 13 duplicates, is 7136. In the class department the teachers report generally in favourable terms of the diligence, good conduct, and attainments of the pupils. It is to be regretted, however, that the classes have been of a more elementary character than those of previous years. This has arisen chiefly from the difficulty of obtaining suitable gratuitous teachers—the extremely low rate of subscription paid by the members precluding the employment of any other kind of aid. From this cause alone the classes for mathematics, book-keeping, and English literature were obliged to be omitted from the operations of the past session. As it is very desirable, however, that important classes like these should be efficiently and regularly conducted in the Institute, it has been matter for consideration whether it would not be advisable, in the next session, to fix an additional fee for these classes, as is the case with those for German, French, and drawing, and by this means secure the services of competent persons to conduct them. The class for the study of animal physiology was opened too late in the session to acquire any decided success. With these exceptions, the class instruction of the past year has been well maintained, with an attendance equal to that of previous years, and with the like satisfactory results. The average attendance at the classes during the last session has been as follows:—Writing and arithmetic, 118; reading (two classes), 60; elementary grammar, 14; elementary grammar (2nd class) 29; grammar (advanced class), 9; geography, 20; English history, 9; chemistry, 16; animal physiology, 5; Latin, 4; French (three classes), 28; German, 15; drawing, 23. At the annual soirée various prizes were distributed to the successful pupils. The certificates awarded by the Society of Arts were also distributed on the same occasion. By the kindness of Alfred Harris, Jun., Esq., (to whom the Institute, and especially the members of the drawing classes, are greatly indebted for the encouragement he has afforded them in their studies), special prizes of £4 and £1 10s. were respectively awarded to John Sowden and W. M. Arundale, for two very excellent drawings from the plaster cast. The following lectures were delivered during the past session. Those marked with an asterisk were gratuitous:—Miss Glyn, reading of the "Merchant of Venice," "Romeo and Juliet," and "Macbeth;" *Rev. J. H. Ryland, President, "Early Life and Writings of Milton;" *W. E. Forster, Esq., "Passages from the History of the House of Lords;" George Grossmith, Esq., "Humorous Characteristics" and "Martin Chuzzlewit;" *Rev. J. R. Campbell, M.A., "Izaak Walton;" Geo. Dawson, Esq., M.A., two on "Good Queen Bess;" Gerald Massey, Esq., "Charlotte Bronte;" *Rev. S. G. Green, B.A., "Writings of Thomas Carlyle;" Walter Rowton, Esq., "Thomas Hood;" *J. V. Godwin, Esq., "British Commerce in the 17th and first half of the 18th Century;" Mrs. C. L. Balfour, "Domestic History of the Bonaparte Family;" *Rev. J. P. Chown, "George Washington."

Chelmsford Literary and Mechanics' Institution. —On Wednesday evening, the 12th ult., a muster of friends of this institution assembled in the hall, to witness the presentation of an elegant dressing-case, value 10 guineas, with a purse of 25 sovereigns, to Mr. J. W. Hair, the respected hon. secretary, as a token of the esteem and gratitude of the members for his able and assiduous discharge of the duties of his office during the last five years. W. W. Duffield, Esq., presided, and briefly addressed the audience, expressing his sense of his own inability adequately to discharge the pleasing duty deputed to him, and regretting that a gentleman (Major Skinner) who would have discharged the duty much more ably and efficiently was unavoidably absent. Turning then to Mr. Hair, the chairman presented the testimonial, begging him to accept it, not as a pecuniary recompense, for it would be a very inadequate one, but as a small expression of their gratitude for the valuable services he had rendered them, and for the most exemplary manner in which he had discharged gratuitously the duties of his office. He begged him to accept the small but valuable present—valuable as expressing towards him their sense of the services rendered, and as showing their kind and grateful feelings. He read the inscription on the dressing-case, which, he said, expressed the feelings and sentiments of every member of that institution. He thought, and he was sure Mr. Hair would agree with him, that the best and most grateful sense a man could have of services performed was the approval of his own mind and conscience, and he was sure Mr. Hair experienced that satisfaction in the highest degree. He was sure Mr. Hair would receive their testimonial with pleasure and satisfaction, and he hoped that the Institution might long continue his services as hon. secretary. He could only further, in his own name and in the name of the Institution generally, express a hope that Mr. Hair might live for many years in possession of every happiness it was possible for man to enjoy; and he was quite sure he would never have occasion to regret having rendered to the Institution the valuable services he had done. Mr. Hair, who was enthusiastically received, acknowledged the gift in an appropriate speech, explaining the circumstances under which, in conjunction with the late Mr. Valpy, he had been induced with much diffidence and hesitation to accept that office, the duties of which he was proud to have discharged to their satisfaction. It was a matter of gratification to him to have been selected for such an office, and he trusted—nay, the proceedings of to-night had convinced him—that his services had been appreciated. He conveyed, in appropriate language, his gratitude to the members for the handsome manner in which they had marked their approval of his services; to the committee for the way in which they had acted in the matter, and for the assistance they had always rendered him; to the chairman for his kindness in presiding; and resumed his seat amidst loud applause. The proceedings closed with a most cordial vote of thanks to the chairman. The Committee have made arrangements for their next lecture session (Oct. to April), having engaged the following professional lectures, &c. Dr. Daniel (four lectures), Mr. Stocqueler, Mr. Robert Hunt, Mr. Parsons, Mr. George Dawson, Mrs. Balfour, Mr. Basil Young, Mr. H. Nicholls, Mr. Pepper, the Rev. P. Wood, Miss Bleadon, and Mr. A. Nicholson; and the following have kindly consented to lecture gratuitously:—The Rev. E. Sidney, M.A., the Rev. J. G. Davies, M.A., Mr. Marshall of Burnham, Mr. H. S. Richards, Mr. Sharman, Tindall Atkinson, Esq., and the Rev. J. G. Hughes.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September* 16*th*, 1859.]

Dated 1*st September*, 1859.

1993. J. A. Simpson, Liverpool—Imp. applicable to hats and other coverings for the head.
1995. T. Aveling, Rochester, Kent—Imp. in locomotive engines.
1997. R. H. Collyer, 8, Alpha-road, Regent's-park—Imp. in preparing materials for the manufacture of paper.

Dated 2*nd September*, 1859.

1999. J. Bernard, Albany, Piccadilly—Imp. in the manufacture or production of boots and shoes, in the machinery, apparatus, and means employed in such manufacture.
2001. W. Brown, jun., and S. Bathgate, Selkirk, N.B.—Imp. in machinery or apparatus for grinding or sharpening the card teeth of carding engines for carding fibrous materials.
2003. W. Fearn, Leeds—An improved construction of buoy.
2005. S. D. Goff, H. Davis, S. Strangman, and E. Strangman, Waterford—An improved method of, and apparatus for, drying malt, corn, and other articles.
2007. E. Button, Smith's-terrace, Chelsea—Improved apparatus for raising sunken vessels.

Dated 3*rd September*, 1859.

2011. J. Friou, 74, Newman-street, Oxford-street—Detaching instantly the locomotives from railway carriages, and also for detaching instantly the harness from horses that run away when attached to any carriage.
2013. H. R. L. Schramm, Breslau, Prussia—A new process for pressing and separating simultaneously the fibres and pellicles contained in the constituent matters of the beetroot, sugar, beer, grains, alcohol, potatoes, beets, and other similar substances.
2015. W. Neilson, Glasgow—Imp. in steam hammers.
2017. J. C. Nixon, Nottingham—Imp. in kitchen ranges, with combined steamer and hot closets, for cooking, warming, drying, or other purposes.
2019. C. Schiele, Oldham, Lancashire—Imp. in weighing machines.
2021. B. Lauth, Manchester—Imp. in the manufacture of rollers or cylinders for calico printers, and of tubes of copper and brass, or mixtures of those metals.

Dated 5*th September*, 1859.

2023. W. Bush, Dulwich, Surrey—Manufacturing granulated seidleitz powder.
2025. J. W. P. Field, 233, High Holborn—Imp. in breech-loading fire-arms.
2027. V. Tomell, 294, King's-road, Chelsea—Imp. in the manufacture of yeast.
2029. A. V. Newton, 66, Chancery-lane—Imp. in weighing machines. (A com.)

Dated 6*th September*, 1859.

2031. R. K. Geldard, Plymouth—Imp. in the method of, and apparatus for making pharmaceutical or other infusions.
2033. F. J. Manceaux, Paris—Imp. in cartridges.
2035. J. Stewart, 66, Tottenham Court-road—Imp. in pianoforte action.

Dated 7*th September*, 1859.

2037. J. J. Lyons, London—Imp. in the manufacture of sugar.
2039. G. Lawrence, York-road, Battersea, Surrey—Imp. in the construction of wheeled vehicles.
2041. W. J. J. Varillat, Rouen, France—An apparatus indicating the level of water in steam caldrons or boilers.
2043. J. P. Joule, Manchester—Imp. in apparatus for refrigerating and condensing steam or other vapours, which said improvements are applicable to refrigerating or heating liquids.
2045. A. V. Newton, 66, Chancery-lane—Imp. in the manufacture of ladies' hooped skirts. (A com.)
2947. E. T. Hughes, 123, Chancery-lane—Imp. in machinery or apparatus for forging metals. (A com.)

Inventions with Complete Specifications Filed.

2072. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved arrangement of piston packing, principally applicable to hydraulic apparatus. (A com.)—12th September, 1859.
2073. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—Imp. in the construction of hydraulic pumps. (A com.)—12th September, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, September* 16*th*, 1859.]

September 15*th.*

660. I. Ash.
664. W. Avery.
671. T. W. Miller.
672. C. Defries.
676. R. A. Brooman.
678. A. G. Hutchinson.
679. P. Larochette, sen.
681. A. Warner and W. H. Tooth.
684. W. B. Taylor.
690. R. Mushet.
691. R. Mushet.
692. A. L. Thirion.
693. C. Lambert.
694. J. W. Duncan and J. E. A. Gwynne.
696. W. B. Gingell.
700. J. W. Hart.
702. J. Howden and A. Morton.
703. R. Mushet.
707. W. Haggett.
712. J. Roberts.
713. S. Leoni.
714. J. Bickerton.
717. W. Rhodes.
727. D. L. Banks.
736. W. Adamson.
790. W. Brown.
792. J. W. Hadwen.
795. T. D. Shipman.
802. J. Lacy, S. Simpson, and H. Smith.
805. T. Ivory.
806. T. Ivory.
857. N. Libotte.
942. W. Sinnock.
1028. W. Stevenson.
1038. W. E. Newton.
1162. A. V. Newton.
1180. T. P. Bennett.
1493. A. Parkes.
1647. W. E. Newton.
1687. W. M. Smith.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, September* 16*th*, 1859.]

September 10*th.*

2115. S. White.
2124. P. A. Balestrini.

September 12*th.*

2059. Capt. J. M. Hayes, R.N.
2142. E. Green.
2147. F. D. Monod.
2159. S. Chodzko.

September 13*th.*

2157. G. C. T. Cranstoun, G. Young, and J. Lovell.

September 14*th.*

2174. D. Crichton and J. Cathcart.
2200. A. Templeton & J. Lawson
2202. W. Young.
2294. J. Holman.

[*From Gazette, September* 20, 1859.]

September 16*th.*

2175. J. Barber.

September 17*th.*

2203. E. Finch.
2206. J. Underwood and F. V. Burt.
2218. W. Taylor.
2253. S. Calley.

Patent on which the Stamp Duty of £100 has been paid.

September 17*th.*

120. G. Collier.

Journal of the Society of Arts.

FRIDAY, SEPTEMBER 30, 1859.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

(*Continued from page* 696.)

Wednesday, September 21.—Some of the Sections met this day to complete the reading of such papers as had stood from the previous day. The following is the list of the papers read:

Section A.—Mathematical and Physical Science.

1. Professor Hennessy.—On the Figure of an Imperfectly Elastic Fluid.
2. J. P. Hennessy.—On the Inclination of the Planetary Orbits.
3. Professor Clerk Maxwell.—On an Instrument for exhibiting the Motions of a Ring of Satellites.
4. Professor Clerk Maxwell.—On the Dynamical Theory of Gases.
5. J. S. Stuart Glennie, M.A.—On a Proposal of a General Mechanical Theory of Physics.
6. J. J. Murphy.—On the Distribution of Heat over the Sun's surface.
7. Professor W. Thomson.—On the Reduction of Professor Forbes' observations of under-ground Temperatures.
8. Professor J. D. Everett.—On the same, with its application to Monthly Mean Temperatures.
9. Dr. Macvicar.—On the Philosophy of Physics.
10. M. l'Abbé Moigno.—On a New Photometer.
11. Professor Von Jacobi.—On the Comparison of Batteries.
12. Rev. T. Dale and Dr. Gladstone.—On the relation between Refractive Index and Volume.

Section B.—Chemical Science.

1. Professor Voelcker.—On Combinations of Earthy Phosphates with Alkalies.
2. Dr. Odling.—On Marsh's Test for Arsenic.
3. Messrs. Mulligan and Dowling.—Quantitative estimation of Tannin in some tanning materials.
4. Mr. C. J. Burnett showed some Specimens illustrating the use of Platinum in Photography.
5. M. Bialoblotzky.—On the Sedimentary Nature of Granite.

Section C.—Geology.

1. Sir David Brewster, F.R.S.—On a Horse-shoe Nail found in the Red Sandstone of Kingoodie.
2. Adolphe Radiguel, C.E.—On a Fragment of Pottery found in superficial deposits in Paris.
3. A. Gages.—Report on the results obtained by the Mechanico-Chemical examination of Rocks and Minerals.
4. C. G. Thost.—On the Rocks and Minerals in the property of the Marquis of Breadalbane.
5. A. Brady.—On the Elephant Remains at Ilford.
6. E. R. J. Knowles.—On some Curious Results in the Water supply, afforded by a spring at Ashey Down, in the Ryde Water-works.
7. Rev. J. Dingle.—On the Constitution of the Earth.
8. J. Price.—On Slickensides.
9. J. Beattie.—On a Cave near Montrose.
10. Rev. J. Morrison.—On the Remains of Lower Oolites in Urquhart, Elgin. Communicated by Dr. Longmuir.
11. W. S. Gibson.—On some Basaltic formations in Northumberland.
12. M. Bialoblotzky.—On the Sedimentary Nature of Granite.

The other Sections did not meet.

At three o'clock the General Meeting of the Association took place in the Music Hall, when the grants of money appropriated to scientific objects by the General Committee were announced. The following is the list, with the name of the member who, alone or as the first of a Committee, is entitled to draw for the money:—

Kew Observatory.	£	s.	d.
At the disposal of the Council for defraying expenses	500	0	0
Chemical Science.			
Sullivan, Professor (Solubility of Salts) ...	30	0	0
Voelcker, Professor (Constituents of Manures).	25	0	0
Gages, Mr. A. (Chemico-Mechanical Analysis of Rocks)	25	0	0
Smith, Dr. Angus (Scientific Evidence in Courts of Law)	10	0	0
Geology.			
Mallet, Robert (Earthquake Waves)... ...	25	0	0
Anderson, Rev. Dr. (Excavations in Yellow Sandstone of Dura-Den)	20	0	0
Murchison, Sir R. I. (Fossils in Upper Silurian Rocks, Lesmahago)	15	0	0
Zoology and Botany.			
MacAndrew, Robert (General Dredging) ...	50	0	0
Ogilvie, Dr. (Dredging North and East Coasts of Scotland)	25	0	0
Kinahan, Professor (Dredging in Dublin Bay).	15	0	0
Daubeny, Dr. (Growth of Plants)	10	0	0
Physiology.			
Allman, Prof. (Report on Hydroid Zoophytes).	10	0	0
Wilson, Dr. (Colour-Blindness)	10	0	0
Mechanical Science.			
Moorsom, Admiral (Steam-Vessels' Performance)	150	0	0
Thomson, Professor J. (Discharge of Water).	10	0	0
	£930	0	0

The business of the Association was wound up by unanimous and cordial votes of thanks to the Lord Provost and the Local Committee for their most successful labours in providing for the reception of the Association, and for the admirable arrangements made for conducting its business, as well as for the hospitality which the citizens of Aberdeen generally had shewn to the members of the Association. Thus ended the business of the Association, and one of the most successful meetings it has ever held.

On Thursday, the 22nd September, a party of about two hundred members of the Association left Aberdeen at six o'clock in the morning for Balmoral Castle, on the invitation of Her Majesty and the Prince Consort. They had a special train to Banchory, about eighteen miles, and posted the remainder of the journey, thirty-two miles, in carriages, previously arranged by the Local Committee to meet them at that place. The day was not very propitious, rain coming on previously to their arrival, showers and wind, with intervals of sunshine, succeeding each other during the whole of the afternoon. The party arrived at Balmoral shortly before two o'clock. Holiday was kept at the Castle. The Farquharson, Duff, and Forbes Highlanders marched in bodies to the grounds, and there were Highland games in part of the Palace. Her Majesty, the Prince Consort, the Prince of Wales, and other members of the Royal family, braved wind and weather, and watched the games with great interest, Her Majesty presenting the prizes with her own hand to the successful competitors. A déjeuner was served for the members of the Association in the ball room of the Castle, and at six o'clock the party started homeward, reaching Aberdeen about one o'clock in the morning.

During the visit a telegram arrived for Sir Roderick Murchison, announcing the arrival of the *Fox* with the news of Captain M'Clintock's successful search for information setting at rest the fate of the long missing Franklin Expedition.

ON THE CONNEXION BETWEEN THE STRUCTURE AND PHYSICAL PROPERTIES OF WOOD.*

By Prof. Knoblauch.

Translated from the "Sitzungsberichte der Naturforschenden Gesellschaft." Halle, 1858, vol. v.

The author seeks to ascertain whether any connexion is ascertainable between the structural relations of various kinds of wood and their observed physical properties, such as their powers of resonance and conduction of heat, &c., in the same way as was done for one and the same wood by Savart in respect to resonance, and more especially by Tyndall in respect to the conduction of heat.

The primary object was to trace the difference in the conduction of heat shown by different woods, according as the heat has to traverse the wood in a direction parallel with, or at right angles to, the direction of the grain. For this purpose, slabs of the woods to be examined were bored through perpendicular to their planes, and then covered as uniformly as possible with a coating of stearine. A hot wire, exactly fitting the bore, was introduced into the latter and continually turned round during the experiment. By this means the coating of stearine around the orifice was melted; but, as we should expect, not in concentric circles, but in elliptic zones, whose major axes invariably coincided with the direction of the grain. The great difference in the behaviour of different kinds of wood (about eighty sorts were examined,) under these circumstances is at once apparent. With some the ellipses are tolerably circular, by others more elongated, while by others, again, the major axes are so extended as to be nearly twice the length of the minor ones. The eccentricity of these ellipses, which furnished a graphical expression for the conductive power of the wood in the directions between which the structural difference was greatest, made it possible to divide the different kinds of wood into four distinct groups. In the first, the ratio of the minor to the major axis of the ellipse is on the average as 1 to 1·25. To this group, acacia, box, cypress, king-wood, &c., belong. In the second, and by far the most numerous group, containing elder, nut, ebony, apple, several dye-woods, &c., the mean value of this ratio is 1 to 1·45. In the third group, to which apricot, siberian, acacia, Brazil wood, yellow wood from Puerto Cabello, &c., belong, the ratio is as 1 to 1·60. In the fourth group it is as 1 to 1·80, and to this division belong lime, tamarind, iron wood, poplar, savanilla (yellow), &c. Hence, the conducting power of all woods in the direction of the fibre exceeds that in the perpendicular direction by no means in a constant manner, but in one which depends upon the nature of the wood. This superiority is in the first group so small, that the warmth in the direction of the fibre traverses a path only a quarter more in length than that traversed in the same time in a perpendicular direction. In the last group, on the other hand, the length of the path in the first direction is about twice that in the perpendicular one.

In order to investigate the relations of resonance, two rods were cut from each kind of wood,—the one being taken in the direction of the grain (langholz), the second perpendicularly across it (hirnholz). On suspending these rods freely (their length was 470 millims., breadth 20 millims., and thickness 8 millims.) and striking them with a stick, the piece cut with the grain always gives a more sonorous tone than the corresponding cross-grain piece. Nevertheless, the difference of resonance in the tones of the with and cross-grain pieces of one and the same wood, of the first of the groups described (say beech), is unmistakably less than the difference between the tones of the with and cross-grain pieces of any member of the second group. In the second group this difference is less than in the third; and in the third, again, less than in the fourth (as with with- and cross-grain pieces of poplar). When, therefore, the fibres of all kinds of wood are set in vibration, the purity of resonance is greater when such vibrations are transverse than when they occur in other directions (as when the rods are cut across the grain). But this superiority of resonance is not constant; it depends upon the nature of the wood. The difference in this respect in the first group of woods is so small, that the resonance of two with- and cross-grain pieces resembles that of two not very dissimilar masses of stone when struck. In the last group the difference is so great, that the tone of the with grain piece when struck has a metallic ring, while the dull sound of the cross-grain piece reminds one of a piece of pasteboard when struck. The division of the woods examined, derived from thermo-conductive power, is accordingly supported by their acoustic relations.

By supporting the two ends of the rods employed in the above experiments and loading them equally in the middle, the degrees of deflexion which they undergo will give us an insight into their structural relations; for the greater their compactness, the greater the resistance they will offer to bending; and the less compact they are, the more easily will they yield. The difference in vertical height of the middle points of the bent and straight rods was taken as measure of deflexion. A lever was employed to determine this measure, the end of which passed over an enlarged scale in order that the readings off might be the more exact. The unit of this measure was a matter of indifference, inasmuch as in the comparison to be instituted, relations only had to be determined. Although, as was to be expected, in all cases the with-grain piece was much less flexible than the corresponding cross-grain piece, yet an important difference was noticeable in the different groups. This is best seen by calculating the relation between the bending (measured as above described,) of the with-grain and that of the cross-grain wood; that is, the same weight being applied (say 100 grs.), by dividing the number given by the lever with the cross-grain piece by that given with the with-grain piece. This relation (called "ratio of deflexion" in the following table) has, in the first group, the mean value of 1 to 5; in the second, 1 to 8; in the third, 1 to 9·5; in the fourth, 1 to 14. The division of the groups is therefore also supported from this point of view.* The difference in the structure in the different directions is least in those woods which show the least difference with respect to direction in their thermo-conductive and resonant properties; and the difference in the former is greater or less as the two latter differences are greater or less.

Hence, a definite relation may be established between the different phenomena described; and this is true to such an extent, that the knowledge of one of them, *e.g.*, the mechanical or state of cohesion is sufficient to deduce the others, those of warmth or resonance.

Thus, merely to adduce one example, especial experiments had shown that in petrified woods a difference of structure in the directions parallel with, and perpendicular to, the direction of the grain had been preserved, and, in fact, the thermal curve was an ellipse whose major axis was parallel to the fibres. As in the petrified example, this difference in mechanical structure was much less than in the living wood, so, also, while in the living Conifer the ratio of the axes was as 1 to 1·80, in the petrified specimen it had sunk to 1 to 1·12.

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* From the Lond., Edin., and Dub. Mag., May, 1859.

* The diversity of nature, even with one and the same kind of wood, of course did not admit of the boundaries of the groups being drawn with great exactness, or of the subdivision of the groups into secondary ones.

The following table contains the names of the woods examined, arranged according to the groups mentioned:—

GROUP I.

Ratio of the axes of the thermal ellipse 1 to 1·25. Mean ratio of deflexion 1 to 5·0.

Acacia.
Box.
Lignum-vitæ.
Cypress.
King wood.
Satin wood.
Salisburia (*Gingko*).

GROUP II.

Ratio of axes of thermal ellipse 1 to 1·45. Mean ratio of deflexion 1 to 8·0.

Elder.
Alder.
White Thorn.
Arbor vitæ.
St. Lucian wood.
Gymnocladus canadensis.
Beech (2 species, white and red).
Plane.
Elm.
Oak (two species).
Ash.
Maple.
American maple.
Cedar of Lebanon.
Australian cedar.
Mahogany.
Palisander.
Ebony.
Palm.
Rosewood.
Snake wood.
Zebra wood.
Purple wood (*Amaranthus*).
Settin.
Coromandel wood.
Angica wood.
Cocoa wood (*Gateado*).
Apple.
Pear.
Cherry.
Plum.
Sandal (red).
Caliatour.
Costarica (red wood).
Bimas sapan.
Cuba (yellow wood).
Viset (yellow wood).
Campeachy blue wood.
Tobasco blue wood.
Domingo blue wood.

GROUP III.

Ratio of axes of thermal ellipse 1 to 1·50. Mean ratio of deflexion 1 to 9·5.

Apricot.
Pistachio.
Siberian Acacia.
Pernambuco red wood.
Japan red wood.
Puerto-Cabello yellow wood

GROUP IV.

Ratio of the axes of the thermal ellipse 1 to 1·8. Mean ratio of deflexion 1 to 14·0.

Willow (two examples).
Chesnut (three examples).
Lime.
Alder.
Birch.
Poplar (three examples).
Aspen.
Pine.
Fir.
Weymouth fir.
Magnolia.
Iron wood.
Tamarind.
Palmassu.
"Kistenholz."
Caoba (Havanna Cedar).
Savanilla yellow wood.

BOTANIC GARDENS AT KEW.

A report on the progress and condition of these gardens from the commencement of 1853 to that of 1859 has been addressed by Sir W. J. Hooker, the Director, to the First Commissioner of H. M. Works.

In the introduction to this report the Director says that its object is to afford a more detailed account of the Royal Gardens, Museums, Herbarium, and Library at Kew, and of the scientific and other services rendered by them to the public, than can be contained in the brief accounts which accompany the annual estimates. It relates chiefly to the last six years; a period which the Director has selected, mainly because, until 1853, this establishment altogether lacked two of the most essential requisites of a National Botanic Garden, namely, a herbarium and a library;* by which only can the objects in the garden and museum be properly named, arranged, and ticketed, and that information be afforded to manufacturers, travellers, and men engaged in the arts, sciences, or horticulture, which is there daily sought.

It is also since 1853 that the new museum has been built and its contents arranged; that a magnificent collection of vegetable products has been acquired from the French Exhibition; that the demand for more ornamental plants in the gardens and conservatories, and for the use of the schools of design, has been as much as possible supplied; that the gardens and museums have been thrown open to the public on Sunday afternoons; that the average of visitors has risen to upwards of 1,000 daily; and that the requests for information, the correspondence on vegetable products, and the number of donors to the establishment have all augmented more than two-fold.

Within this period, too, the most complete aboretum in Europe has been formed in the pleasure-grounds, nurseries have been established for stocking with trees the Metropolitan parks (and these are already found very profitable); the Queen's Garden has been enlarged by 14 acres; and a lake 4½ acres has been commenced in the pleasure-grounds, and an enormous quantity of earth removed from it, at no cost to the public.

As regards the staff, since 1853 an assistant has been appointed to the director, and one to the curator; constables (Crimean soldiers) have been selected to keep order during public hours; the foremen have been put on a better scale of remuneration; while more liberal pay and promotion to the gardeners have greatly increased their efficiency, by rewarding the meritorious, and encouraging the deserving men; and an allowance for medical attendance and support has also been granted, both to gardeners and labourers when sick.

Owing to the unparalleled advantages afforded by these vast collections to scientific men, a large number of works in the English, Latin, French, and German languages have been executed more or less at Kew, by distinguished British and Foreign naturalists, upon Economic and Scientific Botany. An increase has also taken place in the number of young men instructed there, and sent out as naturalists or collectors to Government expeditions and commercial enterprises, or as curators of scientific gardens in England, the Colonies, and on the Continent.

The Director goes on to say:—"Thus it is only within these six years that the Royal Gardens can be considered as becoming a nearly complete national establishment. Till 1853 they were but in course of formation; whereas they now approach that condition when any considerable extension would, in the state of our present commercial and scientific relations, be unadvisable; and when (the long-desired conservatory once completed) we shall do better to economise our means than indefinitely to enlarge them. It must not be forgotten that, 18 years ago, England stood alone in having no national botanic establishment like Paris, Berlin, Vienna, Gottingen, Petersburg, Copenhagen, and even Stockholm; and that within this period we have been called upon to rival foreign gardens, some of which had enjoyed for more than two centuries the lavish patronage of their respective governments; added to which, that (thanks chiefly to the Horticultural Society) the gardens of the universities and of noblemen and private individuals, and of many provincial towns in the kingdom, had attained an excellence during that time which it would have been discreditable to the Royal Gardens not to rival."

After giving an account of the organisation of the staff, the report proceeds to describe the gradual development of the present establishment:—

"On the transference, in 1841, of the botanic gardens, by the Royal Family to the public, they consisted only of 11 acres, and were extended by successive additions till, in 1847, they had reached their present dimensions of 75 acres; this is exclusive of the pleasure grounds. As regards the number of visitors, beginning with 9,174 in 1841, the increase has been gradual to 405,376 in 1858 (exclusive of those to the herbarium and library); while the generally good behaviour of this mass of people, often inconveniently crowding the plant-houses and museums, the eagerness with which they inspect the more curious and interesting plants and their products, and read the notices and explanations given in the guide books and attached to the objects in the museum, all evince that such privileges minister food to the mind as well as health to the body.

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* Till that time these desiderata were wholly supplied by the Director's private herbarium and library.

"The greatest number of persons admitted in one day to the gardens (where they have free access to all parts,) has been 13,761. The best attended months, as may be supposed, are June, July, and August, during which we have numbered so many as 267,223 persons. The fewest visitors are in November, December, and February, when they have been so low as 4,679.

"For the further gratification of the public, the Commissioners have, during the last three years, obtained an increased grant for the higher keep and ornament of the gardens.

"The hours of admission to the Royal Gardens are from 1 p.m. till dusk, on week days, and from 2 p.m. on Sundays. On Christmas day only they are wholly closed.

"Incessantly are applications, personal and written, made for leave to visit the gardens before 1 p.m.; but they are necessarily refused, except to persons who have actual business or other claims to be admitted. Considering that, as previously explained, the whole of the work in the houses and museums must be concluded before noon (the dinner hour for the men), it is obvious that the exclusion of the general public till 1 p.m. must be rigidly enforced; otherwise the foremen cannot be answerable for the safety of their respective collections, or the steady working of their gardeners, who are often addressed, and are in many ways interrupted in their duties, by strangers.

"Connected with the garden establishment is a very important feature—the Gardeners' Library and Reading Room. It consists of two small apartments, adjoining the Director's office, and contains a selection of the more useful works on Horticulture, Elementary Botany, Geography, and Physics, Agricultural Chemistry, Landscape Gardening, and a few volumes of Voyages and Travels, together with two horticultural weekly journals, some maps, and a small supply of stationery for the use of readers. It is open every evening for the gardeners, under the direction of the curator and foremen.

"The pleasure grounds consist of 250 acres, separated by a wire fence from the botanic gardens, and opening into them by four gates. They were placed under my charge in 1846, since which time they have been laid out primarily as an arboretum, for the cultivation of every tree and shrub which will stand the open air in this climate."

Among the more remarkable features of the pleasure grounds are mentioned the arboretum, the nurseries, the lake (which is in process of formation) and the Queen's Garden.

"There will further be the great conservatory (if sanctioned by Parliament), and the flag staff, of Douglas pine," (Abies Douglasii) from British Columbia, a magnificent spar, 118 feet long, which has been presented to the gardens during the preparation of this report, and which it is proposed to erect on a hill in these grounds.

"The peculiarities of the climate of England render it singularly favourable for the growth of a large collection of the trees and shrubs of temperate regions, from almost all parts of the globe; and hence arose the eminent desirableness of attaching to the Royal Gardens such an arboretum as should be worthy of Great Britain, and serviceable to its extensive possessions and foreign relations.

"In pursuance of this object, the best suited localities in these grounds have been devoted to a classified collection of hardy trees and shrubs, amounting to about 3,500 kinds (including marked varieties), and they are mostly in a thriving condition.

"There are two nurseries in the arboretum; one specially intended for planting the Kew Grounds with ornamental trees and shrubs, and rearing a stock for exchange; the other (formed at the desire of the First Commissioner in 1855), to supply the Metropolitan parks. Both are profitable; and the latter has proved to be a very useful part of this establishment."

With reference to the museums of economic botany, the Director says:—

"The formation of this establishment suggested itself to my mind in 1857, when a very humble building (within the precincts of what had been the kitchen and fruit garden), which had been used for the conservation of the fruit for the Royal table, was no longer required for that purpose. It promised to afford, for a time, the needful accommodation for a display of the various products of the vegetable kingdom; especially such as are in demand by the merchant and manufacturer, the timber-dealer, the cabinet-maker, the druggist, &c., and to form, in short, the nucleus of a museum of economic as well as structural botany, which should contain all that was interesting or curious in vegetable organisation, and that could not be preserved nor generally exhibited in the living state. Such a collection could not fail to answer the *cui bono?* so often propounded, by showing the uses and applications of plants. It was commenced by the transference to this building of considerable series of articles of this nature, which the Director had been forming during the previous 40 years, in connection with his own private herbarium; and, thanks to the contributions of friends, in a few years' time the ten apartments (two of them of considerable dimensions) in this museum were full. An additional structure, of much more capacious accommodation, was then required; it was commenced in 1855, finished early in the summer of 1856, and but little vacant space is to be seen in 1858.

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"The cost incurred by increasing the contents of the museum has been exceedingly small; for owing to the interest felt in these collections, it is seldom necessary to buy specimens; they are almost invariably given, and in the case of articles imported into England, often without being asked for. The majority are, however, procured by correspondence direct from the countries producing them.

"Demands for duplicate specimens from the museums are frequently and most energetically urged; and they mostly emanate from public establishments, and especially provincial museums. But I need hardly remark that the preparation, conservation, and naming of museum articles are works of much time, labour, and skill. In most instances the specimens are preserved in glass, often in fluids, and to be of service as museum objects they must be ample and prominent. Thus the value of the specimens is trifling to that of the time consumed in packing, unpacking, selecting, correctly naming, and fitting them for public inspection. To carry out in the museum the complicated system of exchange and distribution pursued in the garden and herbarium, it would be necessary not only to increase the assistants and the present accommodation for duplicates, but to provide a special scientific curator, who should be answerable for the accuracy of the names and proper selection of the specimens sent out, and for such a distribution as should satisfy claimants of all degrees. For it is obvious that errors of information, emanating from Kew, or jealousies excited by apparent partiality to one recipient above another, are not only directly prejudicial to the establishment, but a reflection on it. Duplicates do indeed occasionally accumulate; but much less than is supposed, both because we decline accepting them, and because many articles spoil by keeping, and require renewal. Such duplicates are given away from time to time to individuals who have most benefited the museum and gardens; or they are sent to the colonies, where similar museums are being formed. In conclusion, I would remark that the Kew Museums were established to indicate how such institutions may be founded and conducted, and not as the source whence they are to draw.

"To render the Kew Gardens a complete botanical establishment, a herbarium and library were long a desideratum. True, the very extensive library and herbarium belonging to me were accommodated in a suitable building, the property of the crown; and by an arrangement between the Board of Works and myself, they were thrown open, with the needful attendants, to all men of science. And in 1855, as fully recorded in former reports, two collections of dried plants (Herbaria) were added as gifts, and they now form that portion of this department which belongs to the crown. These, combined with my own, unquestionably constitute the most extensive and practically useful herbarium and library ever formed; and they cannot fail to be, and have indeed already proved, of inestimable service to all who are engaged in subjects connected with botany and horticulture."

In proof of this assertion the Director subjoins a list of the thirty-six principal works, more or less completely carried out by means of the ready access granted to these collections, confining himself, however, to those which have been in progress during the last six years.

"I have here to mention that this establishment has, during the last year, rendered a most important service to Indian botany, by rescuing from total destruction the enormous collections of plants made under the orders of the Indian Government, by officers of their service, and which had been accumulating for thirty years in the cellars of the India House. In consequence of the urgent remonstrances that emanated from Kew, the Honourable East India Company consented to these collections being arranged under our supervision, and to defray the necessary expenses for carriage, materials, and assistance in arranging and preserving them. In July last, the collections arrived and the work of inspection and selection commenced. The whole are still regarded as appertaining to the department of the Government of India, who will decide upon their ultimate destination."

After noticing the collection of botanical prints and drawings, the report concludes by pointing out the further service rendered by this garden to horticulture and botany, in the several missions and botanical explorations that have been carried out of late years, to the great promotion of science.

RESTORATION OF DAMAGED LETTERS.

Mr. Alfred Smee, of the Bank of England, gives the following information on this subject:—

"Many letters have been delivered by the Indian mail greatly damaged, and in some cases perfectly illegible, from the action of the sea-water, at the late injury of the *Northam*. I have successfully restored the writing of one of these letters by a process I believe to be as old as the hills, though I am assured quite unknown to our merchants and bankers.

"Having been requested to publish this process for their information, I have only to state that the recovery of writing so obliterated is extremely simple.

"The letter should be lightly once brushed over with diluted muriatic acid, the strength sold as such at all chymist's shops. As soon as the paper is thoroughly damped, it must be again brushed over with a saturated solution of yellow ferruginate of potash, when immediately the writing appears in Prussian blue. In this latter operation plenty of the liquid should be employed, and care must be taken that the brush be not used so roughly as to tear the surface of the paper.

"This result is obtained by simple chymical laws, as the iron which existed in the writing-ink is retained in the fibre of the paper, and by the action of ferruginate of potash, Prussian blue is formed, the use of the muriatic acid being simply to place the iron under circumstances favourable to the action of ferruginate of potash.

"The letter should then be washed in a basin of clean water, and dried first between the folds of blotting-paper, and subsequently by holding it before the fire, when the letter is fit for the counting-house.

"If the letter should be of much permanent value, I recommend it to be carefully sized with a solution of isinglass before being filed; but if the paper has been much rotted, the operation requires care, and should not be done until a notarial copy or photograph has been taken.

"Where the operation is to be conducted by those having some knowledge of chymistry, a little of the solution of the red ferruginate of potash may be added to the yellow, as in some cases it would render the colour more complex."

COTTON SUPPLY.

The following has appeared in the *Daily News*:—

The Cotton year of the United States—in the crop of which, through our manufacturers and others, all the world is interested—always terminates on the last day of August, and we are now in possession of its history for 1859. Between September 1, 1858, and August 31 last, the quantity of Cotton received at the different ports, equivalent to the total crop, was 3,710,000 bales, against 3,078,000 bales in the preceding year—an increase of rather more than 20 per cent., but only 6 per cent. more than the large crop of 1856—3,492,000 bales. Taking the average of the five years 1855-1859 as the crop of 1857, and the average of the five years 1840-1844 as the crop of 1842, the increase in the interval of fifteen years is 60 per cent., or 4 per cent. per annum. As this is much greater than the increase of population in the interval, it is another proof of the continued general improvement in clothing, of which cotton is one of the chief raw materials.

Taking the value of each bale at 30 dollars, we may estimate the total value of the cotton crop of the States in 1859 at £24,000,000. The bulk of it, or 3,000,000 bales (actually 2,990,000) is exported, leaving 700,000 bales for home consumption, so that the States supply other nations with cotton of the value of about £18,000,000 a-year. Of the exports, 2,015,000 bales come hither, 441,000 go to France, and 543,000 go to other ports. The States supply mankind with many other things; but cotton, like the tea of China, the wine of France, the oil of Italy, the timber of Scandinavia, may be considered as the distinguishing and chief industrial product which they contribute to the well-being of society.

For us, however, the most interesting and important part of this subject is the quantity of cotton sent hither. It is, in 1859, 2,015,000 bales, against in

1858.	1857.	1856.	1855.
Bales.	Bales.	Bales.	Bales.
1,796,000	1,422,000	1,946,000	1,543,000

It is therefore considerably in excess of each of the previous four years except 1856, when it was only slightly below the present amount. In that year the crop was unprecedently large; in the following year the manufacturers were extremely busy, and the enlarged supply was adequate to their enlarged demands. In 1857 and 1858 the crop was small, below what may be considered the average, and insufficient for the enlarged and increasing demand of the manufacturers. The price in consequence, taking Uplands cotton as the example, rose in the Liverpool market from 5⅝d. per lb. in September, 1856, to 8d. in September, 1857, to fall to 6 5-10d.

in September, 1858; at present it is 5⅞d. per lb. In the great rise of price in 1857 lies the origin of the anxiety felt by our manufacturers lest the supply of the raw material should fall below their wants. The subsequent increase in the supply should dispel these apprehensions. Formerly the average increase of the supply of cotton was estimated at 3 per cent. per annum; but the late returns show, as we have observed, a continual increase of 4 per cent. per annum. The markets, too, testify to the comparative abundance, for the price is now only a single farthing per lb. above the price of the very abundant year 1856.

The apprehensions of a want of the raw material have led to many speculations and efforts on the part of manufacturers to increase it. Cotton spinners and weavers, however, are not cotton growers. It is their duty, as it is the duty of all men, to do their own work well, and trust that other men are doing equally well their part in the great system of combined production. They know nothing of the consumers of their manufactures, and very little or nothing of those who produce the raw material. Owing to the division of labour they have generally, nay, invariably, found their own wants of all other things, as well as cotton, supplied when they brought their own commodity to market, and were enabled by selling it to buy what they wanted. They must not think, therefore, of being cotton growers as well as cotton spinners, but be content to perform their own task well and trust to others to supply them with the cotton they need. They have seen, indeed, great fluctuations in the value of cotton, the consequence of varying, though generally increasing, demand and varying seasons; the extremes through a long series of years have been between 3d. and 9d. per lb.; but the fluctuations have on the whole latterly diminished, and will diminish faster as the sources of supply become more numerous and nations become more manufacturing.

Last year, to the end of December, our total imports of cotton were 1,034,342,176 lbs., of which we derived 823,000,000 lbs. from the United States, and the remainder chiefly from the British East Indies and other countries. Of these imports, however, we re-exported 149,600,000 lbs., leaving for our supply 885,700,000 lbs. We have seen, however, that the exports from the United States to other countries than Great Britain, chiefly in Europe, were almost one-half as great as the exports hither; and adding to them the exports from our country, we shall get a tolerable measure of the cotton manufactures of the other countries of Europe. Supposing that they get no supplies direct from the East Indies, the Brazils, and Egypt, but obtain all their supplies of the cotton of those countries through England, which is not exactly, but nearly, the fact, their supply and our supply stand thus:—

	lbs.
England's supply in the year ended December, 1858	885,700,000
Foreign supply from United States, year ended August, 1859	299,300,000
Foreign supply from England, year ended December, 1858	149,600,000
Total foreign	448,900,000

According to these figures, which do not represent the precise truth, but very near it, the consumption of cotton in Europe, excluding England, is about 448,900,000 lbs., while the consumption of England is not quite twice as much. Abroad, too, the consumption is increasing very fast. Since 1844 our exports of cotton thither have increased more than threefold, viz., from 421,650 cwts. to 1,335,790 cwts. in 1858. The exports from the United States thither have also increased, but not in equal proportion. It is, however, plain from these figures that Great Britain, though still the largest consumer of cotton, is by no means the *only* consumer, and that any increase of the raw material and any reduction in its price will be equally to the advantage of all the cotton manufacturing countries of Europe and the world. It may be even concluded, as the proportion of fine to coarse fabrics produced is much greater in England than in other countries, that the increase in the supply of the raw material, and the reduction of its price, will be more to their advantage than ours. They use more cotton proportionately for their fabrics than we do for ours. These two facts, that every increase in the supply of cotton will affect the general market, and will not be exclusively to our advantage, and that it may probably be more to the advantage of the foreign manufacturer than our own, should have some influence with those who are now earnestly recommending the policy of encouraging the production of cotton in our Indian territories.

We concede readily that to India, accustomed to have her industry much regulated and directed by her Governments, such a policy may be eminently advantageous. For the sake of India, therefore, let it be prosecuted. But the English people and the English manufacturers must not expect that they will exclusively benefit by an increased supply of cotton at lower prices. The advantages will be shared by all the manufacturers and all the wearers of cottons. The manufacture and use of improved clothing will be extended, but the extension will be quite as much or more in other countries than our own. Even with regard to the industry of nations it ought to be recollected, that the production of one commodity cannot be favoured except that of some other is checked, and that the wants of communities and individuals, expressed by prices, are better regulators of production than the most sagacious policy.

The following letter has been addressed to the Editor of the *Daily News*:—

Sir,—I have perused with pleasure your leading article of to-day on the subject of cotton, and am happy to bear testimony to the general correctness of your statements. I note some inaccuracies, however, to which I beg your attention.

In the first place, you estimate the value of each bale of the last American crop at 30 dollars in that country, whereas 50 dollars would be nearer the mark. The average price paid for the last crop may be roughly stated at 11 cents., and allowing the bales to average 440 lbs. gross weight, the value of each would be nearly £10; and we have little doubt that the late crop, which will prove about 3,750,000 bales, will realise 35 millions sterling, instead of 24 millions, the amount you compute it at.

In comparing the price of this staple for the last four years you take Upland cotton for your standard, but obviously base your quotations on a very low quality, instead of taking "middling" for your guide, the standard usually employed, and always implied when not specially alluded to. Your quotations for that quality would be about ¾d. per lb. higher than those given, and which casual readers may falsely apply to it.

Lastly, I would observe that you underestimate the proportion that the continental consumption of cotton bears to our own. Instead of being about one-half, it is upwards of two-thirds, and will this year exceed 1,500,000 bales, while that of Great Britain will be about 2,250,000 bales. This error is chiefly owing to a mistake made in reckoning the weight of the American cotton exported to the continent, and which you place at 299,300,000lbs., whereas allowing 420lbs. per bale net weight, and calling the export to the continent last season 1,000,000 bales, the aggregate weight would be 420,000,000lbs.

If you insert these remarks you may remove misapprehension, and would oblige—Yours, &c.,

MERCATOR.

Liverpool, Sept. 23.

FILE CUTTING MACHINERY.

A paper on this subject, by Mr. Thomas Greenwood, of the firm of Greenwood and Batley, Leeds, was read before the members of the Institution of Mechanical Engineers during their recent meeting at Leeds, which began on Tuesday, the 6th inst.

In the course of his paper, Mr. Greenwood alluded to the fact that whilst machinery had been introduced into most manual operations, file cutting remained stationary. Various machines had been invented in America and in this country, and large sums of money had been spent by manufacturers in Sheffield, but partly from difficulties, real and imaginary, and also from the opposition of the operative file cutters, these experiments had failed up to within a recent period. So great were the prejudices of the operative file cutters that they refused to teach the apprentices how to grind their cutting chisels until the last year of their apprenticeship, and the tariff of prices remained fixed, on the supposition that no improvement had taken place in the rolling of steel, thus entirely ignoring the progress which had been made; and forgers charged the same price for drawing the taug upon a round or square rod of steel for a parallel or equalling file that they did for forging a half round taper file of the same length. The actual process of file cutting, however, was one of the simplest description. It consisted in driving a chisel of suitable form and inclination to a small depth into the prepared surface of the blank, and steadily withdrawing it again. The difficulties to be surmounted were, to present the blank perfectly parallel to the cutting edge of the chisel; to withdraw the chisel from the incision made in the blank without damaging the edge of the newly-raised tooth; to prevent a rebound of the chisel after the blow which drove the chisel into the blank, before the next blow was struck; to give a uniform traversing motion to the blank, ensuring regularity in the teeth; to proportion the intensity of the blow to the varying width of the file, so as to give a uniform depth of cut; and to perform these operations at such a speed as to make them commercially profitable. In most of the attempts which had been made, the idea had been to construct an iron arm and hand to hold the chisel, and an iron hammer to strike the blow, but the vibration which attended this mode caused irregularity in the work and a ragged and uneven edge on the tooth. The slow speed, too, at which these machines were worked rendered them unable to compete with hand labour. In the machine invented by M. Bernot, of Paris, these difficulties were obviated. The blow was given by the pressure of a flat steel spring pressing upon the top of a vertical slide, at the lower end of which the chisel was firmly fixed. The slide was actuated by a cam, making about one thousand revolutions per minute, and the chisel consequently struck that number of blows per minute, thus obviating the vibration consequent upon the blow with an iron-mounted hammer. After explaining the machine more minutely, by means of diagrams, Mr. Greenwood remarked, with regard to the durability of the cutting chisels, that it was found that they cut five times as many files as could be cut by hand, without re-sharpening. In the files cut by this machine the teeth were raised with perfect regularity, and consequently, when the file was used, each tooth performed its proper share of work; whereas, in hand cutting, from the varying power of the muscles, especially towards the close of the day, it was impossible to produce such perfectly uniform work. Every description of round or half-round files was cut by the use of a revolving bed, and dividing apparatus for round and half-round files. The paper concluded by stating that a manufactory, employing twelve of these machines, had been established at Douai, in the north of France, and another had been established at Brussels.

A machine, which had been fitted up in the room, was put into operation by means of manual power, which, however, could not give the full velocity, but notwithstanding this the work done was of a satisfactory character, the files cut being the full sized flat hand files. A discussion ensued, and in reply to Mr. Fothergill, Mr. Cowper, and others, Mr. Greenwood said that the relative cost of cutting the files, as shown by practice at Douai, was as 4d. per dozen to 2s. 8d. for manual labour, on a certain class of work, which left a large margin after the cost of the machine and power in favour of machine work. As to the durability of the files, it was decidedly greater than that of ordinary files. The difference of production was as ten to one, and the machine would last as long as ordinary complicated machinery. There was no difficulty in cutting round and half-round files. There was also an additional advantage in the equality of the work obtained. In hand labour it was found that the files made were not so good in the afternoon as those made in the morning, the muscles becoming relaxed, and the blow therefore less regular in force. It cut the taper files all one depth, but no doubt the pitch could be altered if necessary, by making the machine a little more complicated.

On the suggestion of Mr. Maudslay,

Mr. Greaves, who had charge of the machine, briefly addressed the meeting. He said that he had been engaged in file cutting twenty-five years, and he was prepared to state that the machine would cut as good files as could be made by hand, if properly attended to. It was necessary, however, that the machine should be fixed, and not re-set every half-hour.

The President then thanked Mr. Greenwood for his paper, and the discussion terminated.

WATER IN LIGHTHOUSES.

The following letter has been addressed to the editor of the *Times*:—

Sir,—The Trinity-house, in its care for the health of the people engaged under it in the superintendence of lighthouses, has at different times sent to me, as its scientific adviser, certain specimens of waters, which were supposed to be injurious to the persons using them. Lighthouses are, of necessity, often placed in situations where water is obtained with difficulty, and they are frequently dependent, more or less, upon that which is gathered from rain falling upon the leaden roofs, galleries, and gutters of the towers and cottages occupied by the keepers. Now, the salt of the sea spray, which often reaches these roofs, &c., even when they are half a mile or more from the shore, causes the rain water which falls upon them to dissolve a portion of the lead, which is larger or smaller under different circumstances, and at times rises up to a quantity injurious to health, and poisonous. The water thus contaminated by lead, or rather chloride of lead, is peculiar in this, that it does not lose the poisoning substance either by boiling or by exposure to the air, for the matter remains soluble after one or both of these processes. I ascertained that if a little whiting, or pulverized chalk (carbonate of lime), were added to such water, and the whole shaken or stirred together, the lead immediately assumed the insoluble state; so that when the water was either filtered or left to settle, the clear fluid was obtained in a perfectly pure and salubrious condition. The process of purification is, therefore, exceedingly simple, for if some powdered chalk or whiting is put into the cistern in which such rain water is collected, and stirred up occasionally after rain, the water may, with the greatest facility, be obtained in a perfectly fit state for all culinary and domestic purposes.

The Trinity-house has supplied this information to all the cases needing it which have come to its knowledge, but I find that some cases occur not under its charge, that there are others not connected with lighthouses, and others again in other countries, in all of which this piece of simple practical knowledge may be useful. Under these circumstances I have thought that you, Sir, would not refuse the service of that special and extensive power of publication and instruction which the *Times* possesses, but use it to carry this knowledge to the many dispersed persons who may greatly need and yet have no other means of obtaining it.

I am, Sir, your obliged and faithful servant,

M. FARADAY.

Royal Institution, Sept. 22.

COILING SUBMARINE TELEGRAPH CABLES.

A method of coiling submarine telegraph cables, whereby the danger of kinking is stated to be avoided, has been proposed by Captain L. G. Heath, R.N., C.B. In describing his plan the author says:—

"In all spirally twisted rope there is a certain state as to the amount of twist which may be called the normal state—a state in which there is no tendency in the rope when freed from all external agency to revolve either one way or the other—but if by any means an additional twist should be put into the rope, whilst in this normal state, it will have a tendency to untwist itself, whilst on the other hand if a twist is taken out, it will have a tendency to twist itself up again. It is in this normal state that the cable is delivered by the manufacturer, being generally wound on a drum, and if it could be payed out direct from that drum by its revolution round its axis, it would be submerged in its normal state, and no danger of kinking would arise. This was the plan adopted in laying the Black Sea Telegraph Cable during the Russian war, and it should be and probably is adopted for all short lines, but the impossibility of coiling such a mass as the Atlantic cable on one drum, or of controlling its speed if it were so coiled, and the difficulty of connecting the ends if the cable were divided into parts and coiled on several smaller drums to be used in succession, seem to render this plan impracticable for long cables; they are therefore transferred from the manufacturer's drum to the hold of the laying out ship, where they are most carefully coiled on flat platforms. It is this coiling which produces a tendency to the formation of kinks, because for every circle made in the process an extra twist (beyond the normal number) is put into the rope, which extra twist remains in the rope when it is payed out, as may be shown to those new to the subject, by the following simple experiment.

"Take 20 or 30 fathoms of rope in its normal condition as to twist, and place it straight along the ground so that it shall represent the rope when just completed in the manufacturer's rope walk, paint a line along the whole length of its upper surface, and then, making one end fast to a low peg in the ground, imitate the process of coiling it into a ship's hold, count the number of circles formed, and laying hold of the last coiled end walk away with it (as if the cable were being submerged) until the rope is again stretched out, and you will see the painted line spirally wound round with a number of circles made in the first part of the experiment. Now this is, on a small scale, exactly what happens when a larger cable is coiled in and laid out from a ship in the usual manner; a number of twists in excess of what I have called the normal number are put into the cable, and in that state is the cable laid out. If in your experiment you have used a cable of the ordinary stiffness and rigidity, you will have seen plainly how these extra twists tend to form the much dreaded kinks. In shoal water on a regular bottom the danger is but small, because the friction of the rope on the ground will prevent the twists working up towards one another, but in deep water with rough bottom, the cable will, as has frequently been suggested, perhaps hang suspended between distant points, and it is then more than probable that these twists will work up by a sort of worm-like motion towards one another, and form knots of kinks such as were described as having been found in the Atlantic Telegraph Cable.

"Newall's cones and rings are valuable contrivances for preventing the formation of kinks whilst the cable is leaving the ship, but they do not destroy the materials of which kinks are formed. Those materials, under the common system of coiling, leave the ship with the cable and are evermore present with it, ready to develop themselves as kinks whenever favourable circumstances arise.

"The remedy which I propose is to coil the successive sheaves alternately right and left-handed, so that the right-handed twists formed in one sheave will be exactly neutralized by the left-handed twists in the next, and the cable will thus be submerged in its normal state."

STEAM TOWAGE OF BOATS ON CANALS.

Many attempts have at various times been made* to employ upon canals steam tugs, propelled by paddles or screws, in place of traction by horses. The objection raised against them, however, is always the same—that the waves created by the propelling surfaces injure the banks, gradually washing them down into the canal, and thus decreasing its depth. An ingenious but very simple contrivance is now being applied for achieving the object without either paddle or screw, or, in fact, any other means of propulsion, strictly so called. The mode employed is practically one of traction, by chains, acting on the bottom of the canal or river, instead of upon the towing path at the side. The plan is the invention of Mr. William Robertson, engineer, of Strangeways, Manchester, who has patented it, and the principle is being carried out by "The Chain Propeller Company." The new method has been tested by experiments, with the sanction of Mr. Fereday Smith, on the Bridgewater Canal, between Patricroft and Leigh. An ordinary canal flyboat has been adapted to the purpose. It is 70 feet long, and 7 feet beam, but a new one, of more suitable model, is in course of construction. An engine, of about 8-horse power, is placed on the fore part of the boat, which drives a shaft having a grooved wheel, 2 feet 4 inches in diameter, projecting slightly from each side of the bow. There is a similar pair of wheels, or rather pulleys, near the stern, one on each side. An endless chain is then placed (on each side of the boat) upon the fore driving wheel and stern pulley, with sufficient slack in it to admit of its reaching to, and lying upon, the bottom of the canal. At the first experiment, the chain used was 20lb weight to the yard, and it was one of the lightest employed. The driving wheels and stern pulleys are 57 feet apart, but there is a series of smaller running pulleys over which the chain passes after it has come out of the water at the stern, on its way to the wheels at the bow. The weight of the chain used is in proportion to the weight to be drawn, and to the power of the engine. For towing purposes, four chains—two on each side—are employed. The chain may be regarded as constituting an anchor, lying along the bottom, which the engine is continually heaving in at the stern, and as continually depositing a fresh supply at the head. By this action, it will be seen that a fulcrum is obtained without the water being scraped away from the sides, as by paddles, or forced away from the stern and bottom, as by the screw. At the trial trip there were on board Mr. Bryson, the resident engineer of the Bridgewater Trust; Mr. Marsden, Mr. Grundy, and Mr. Kent; Mr. Robertson, the inventor, and several other gentlemen. The distance from Worsley Bridge to Leigh is six miles, and it was run, with the single light chain, in an hour and a half, being four miles per hour. There was found, however, to be too much ballast in the stern of the boat, the progress of which was retarded by the hind pulleys dipping into the water. This was remedied in returning, and the speed was nearly five miles per hour. A careful observation showed that the chain had travelled eight miles while the boat had travelled six; or that the slip of the chain along the bottom of the canal was nine inches in each yard. The general impression seemed to be that with two chains (or one of double weight), which would double the amount of grip upon the bottom of the canal, this slip would almost entirely disappear. By this mode of progression the water is in no way disturbed, as there is, of course, nothing in the dropping of a chain into the water and hauling it out again which can ruffle the surface. The conditions are precisely the same as those of a vessel drawn at the same speed by horses, except that the descent of the chain from each bow, rather tends to break the wave caused by the head of the boat. The experiments were devoted subsequently to the towage of laden coal boats, when two chains were employed. The plan has been tested, and the result proved highly satisfactory. The slip, by the use of two chains, was entirely removed. The speed attained was double that by horses with an equal load.

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* A similar invention was tried some years since by a Captain Brown, but without success.—ED. *J. S. A.*

SILKWORM OF THE AYLANTHUS.

Some further researches in reference to this silkworm, which is stated to be the true *Bombyx Cynthia* (see *Journal*, Vol. VI., p. 630) have been lately laid before the French Academy of Sciences, by M. F. S. Guérin-Méneville. These investigations were undertaken by order of the Emperor, in the department of Var, in the south of France, and were carried out on a considerable scale.

Some of the silkworms were placed in a closed room, others in a greenhouse constantly open both day and night, and others in the open air on frames left constantly exposed, and fixed upon moderately high trees, covered with nets to keep off the birds. It is remarkable that the silkworms kept in the open air were exposed to several violent storms of wind and rain, without suffering any injury.

The conclusions which M. Guérin-Méneville draws from his experiments are that these silkworms may be considered as acclimatised in France, and can be kept on trees in the open air, almost as easily as in China; that cocoons produced in this manner are larger and richer than those which result from worms kept either in close or open rooms. He is of opinion that their management presents little difficulty, and would be found very inexpensive when once the breeding of the worms became regularly organised.

The tree on which the worm feeds is stated to grow in the worst kinds of soil, where little else will flourish, and with regard to the textile material which it is believed will thus be produced at a low price, M. Guérin-Méneville thinks it will become in France, what it has long been in China, the silk of the people.*

Proceedings of Institutions.

SYDNEY MECHANICS' SCHOOL OF ARTS.—The Report for last year states that various unavoidable circumstances have combined to limit the Institution's sphere of operations and usefulness. Amongst these may be mentioned the continued depression of trade; the removal from Sydney of many members, owing to the excitement attending the Fitzroy diggings; the multiplication of institutions similar in many of their objects to the Sydney School of Arts; the long continued illness of the Secretary, originally brought on by the very defective sanitary condition of his apartment on the premises of the Institution; and lastly, the want of suitable accommodation for the members generally in the present inconvenient and unsightly building. Most of these causes of depression, however, the committee regard as temporary in their character, and they look forward with confidence to a brighter and more successful future. The reading-room continues to be very well attended, and is, beyond question, the most complete and satisfactory department of the Institution. During the past year the sum of £223 17s. 4d. has been devoted to it, of which £146 17s. 7d. were remitted to England, and £76 19s. 9d. disbursed in the colony. In the library department some signs of progress may be discerned. The number of volumes added since the last report is nearly 600, of which about 450 are entirely new works. Some of the additions made, and others which are ordered, are works of a permanently useful character. Without wishing to discourage reading of a lighter and more amusing sort, the committee have felt that the shelves of this Institution ought to contain a greater proportion of works calculated to elevate the literary tastes and inform the minds of the members. The library of a Mechanics' School of Arts should, in their opinion, be something very much better than a mere cheap circulating library. It should contain such standard books on the various branches of science and art, social and political economy, &c., as will enable the students in the various classes, the members of the discussion class, and the attendants at the lectures, to carry out their studies to definite and satisfactory conclusions. The whole number of volumes now in the library is 7,200, and the issues during the year have been about 25,000. The sum of £219 3s. 9d. has been expended in the library during the year. The following is a list of the lectures delivered during the past year, and an inspection of it will show how much the Institution is indebted to its friends for their gratuitous as well as able and efficient services:—Inaugural Address, by His Excellency Sir W. T. Denison, K.C.B.; "Currer Bell and her Writings," by J. L. Michael, Esq.; "Why we breathe and how," by S. Boyd, Esq., M.D.; "Egypt in the Olden Time," by the Rev. G. H. Stanley, B.A.; "On Law," by J. F. Hargrave, Esq.; "New Truths and their Reception," by C. Meymott, Esq., M.R.C.S.; "Why we breathe and how," (second lecture) by S. Boyd, Esq., M.D.; "A Sojourn in France," by C. Kemp, Esq.; "Natural and Artificial means of Locomotion," by J. Dyer Esq.; "A Sojourn in Mexico in 1832 and 1833," by S. A. Donaldson, Esq., M.L.A.; "Pompeii, or Life in Ancient Italy," by A. Gordon, Esq.; "Air, and some of its Properties," by A. Cane Esq.; "Meteorology," by the Rev. W. Scott, Colonial Astronomer; "On Drawing," by J. Fowles, Esq; "Elementary Mechanics," by Rev. D. Boyd; "Carbonic Acid," by Professor Smith; "On the study of English Law," by J. F. Hargrave, Esq.; "Greek ideas of Pleasure and Love," by Professor Woolley, D.C.L. Classes in the following subjects have been carried on during the year:—French, Drawing, Mathematics, English Grammar and Composition, and Elocution, Vocal Music, Latin. In connection with the subject of Class Examination the Committee call attention to the practice, now so general in the home countries, of requiring certificates of qualification from all candidates for appointments to the civil and military services. The important results produced by this, on educational institutions, are already observable; and the Committee are of opinion that an application of such a system to this Colony, in connection with the Schools of Art and other educational institutes, would furnish a healthy stimulus to the young men of Australia. The erection of a suitable and convenient building for this Institution has long been an object of most earnest desire on the part of its Committee. The requirements of the ordinary operations have considerably outgrown the accommodation afforded by the premises, and further usefulness is for the present checked. Accordingly the Committee have determined to enlarge the present building, the cost of effecting the new works being estimated at about £3,000. The number of entirely new members who have joined the Institution since last Report is 309. The total number of existing members is 846. The treasurer's account shows that the income of the year was £1149 2s. 5d.

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* See also a paper on the silkworm of the *Ricinus*, in the resent Vol. of the *Journal*, page 670.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette*, *September* 23*rd*, 1859.]

Dated 6*th August*, 1859.
1814. C. C. R. Goudenove and A. Feret, 60, Rue Neuve St. Augustin, Paris—An imp. in gas burners. (Partly a com.)

Dated 16*th August*, 1859.
1886. W. Leatham, Leeds—An improved double acting superlative screw throttle valve.

Dated 22*nd August*, 1859.
1910. J. Gregory, Barreiro, Portugal—Imp. in locomotive and other steam engines.

Dated 30*th August*, 1859.
1970. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the construction of steam generators, applicable also to the construction of condensers, the heating of water generally, and to the warming of buildings. (A com.)
1972. G. Collier, 23, Elizabeth-street, Eaton-square—Imp. in chairs and couches.
1974. J. Field, Lambeth—Imp. in apparatus for superheating steam.
1976. H. Hutton, Palace-road, Lambeth—An improved lubricator.

Dated 31*st August*, 1859.
1978. J. Cowgill and J. Stocks, Bradford—Imp. in caps for spinning fibrous substances, and in the means or method of manufacturing the same.
1980. W. A. Von Kanig, Hardinge-street, Islington—Imp. in the manufacture of starch and compounds of starch, and in extracting gum dextrine and grape sugar therefrom.
1984. J. Mackenzie and T. Wentworth, St. Martin's-le-Grand—Imp. in breech-loading fire arms.
1986. J. Samuel, Great George-street, Westminster—Imp. in railway sleepers.
1987. H. Higgin, Bow, Middlesex—Imp. in machinery for cutting and preparing match splints.
1988. L. Berge, Newgate-street—An improved method of fastening or securing portemonnaies, bags, and other like articles with frames.
1990. E. Ellis, St. Ann's Well-road, Nottingham—Imp. in finishing silk fabrics made on bobbin net, and warp frames.

Dated 1*st September*, 1859.
1992. J. Brine, Maidstone, Kent—Imp. in the mode of preparing, arranging, and combining the leaves of books to be used for producing simultaneously one or more fac-simile copies of letters, accounts, or other such similar documents or writings.
1996. J. Borrington, Derby—Imp. in pumps.

Dated 2*nd September*, 1859.
1998. P. Wright, Dudley, Worcestershire—An imp. or imps. in the manufacture of anvils.
2002. J. K. Watson, Edinburgh—Imp. in gas meters and exhausters, washers, and purifiers.
2004. W. Clough, Wigan, Lancashire—Certain imp. in machinery or apparatus for propelling vessels on water.
2006. W. A. Turner, Manchester, and H. L. Lilley, Stand-lane, Manchester—Imp. in the manufacture of starch.
2008. J. F. F. Leroux, 29, Boulevart St. Martin, Paris—A new or improved apparatus to be employed for taking money on the counters.
2009. T. Hedgcock, Ivy-cottage, Great Church-lane, Hammersmith—An imp. in quadrants.
2010. J. Spurgin, Great Cumberland-street, Middlesex—Imp. in ordnance and projectiles.

Dated 3*rd September*, 1859.
2018. G. Parsons, Martock, Somersetshire—Imp. in wheels.
2020. H. Swan, 5, Bishopsgate street Without—Imp. in stereoscopes and stereoscopic pictures.

Dated 5*th September*, 1859.
2022. F. C. Bakewell, 6, Haverstock-terrace, Hampstead—Imp. in the manufacture of caustic alkalies. (A com.)
2026. W. L. Earle, Alfred-place, Bedford-square—Imp. in apparatus for promoting the combustion of smoke and gases arising from fuel.
2028. A. V. Newton, 66, Chancery-lane—Imp. in sewing machines. (A com.)

Dated 6*th September*, 1859.
2030. G. Lowry, Salford, Lancashire—Imp. in machinery for heckling flax and other fibrous materials.
2034. A. V. Newton, 66, Chancery-lane—An improved fabric, applicable to the manufacture of hose or flexible pipes. (A com.)
2036. E. Blake, 61, Tachbrook-street, Pimlico—Imp. in apparatus for and in treating China-grass rhea, fibre mudar, and other similar vegetable fibres.

Dated 8*th September*, 1859.
2049. T. Hoodman, 490, Oxford-street—An improved stock, cravat, or neck muffler or wrapper.
2051. J. Nicholson, Chaple House, Hensingham, Whitehaven, Cumberland—Imp. in horse rakes.
2053. J. Thorley, Newgate-street—An improved preparation of food for cattle and horses.
2055. T. W. Allsopp, Castle Donington, Leicestershire—Imp. in portable gas apparatus.

Dated 9*th September*, 1859.
2057. W. Roscoe, Croxteth Hall, West Derby, Lancashire—An improved agricultural implement or machine for distributing guano and other manures upon land.
2059. J. G. N. Alleyne, Butterley Iron Works, Alfreton, Derbyshire—Imp. in the manufacture of wrought-iron beams.
2061. F. Carpenter, Porter-street, Westminster—An improved apparatus for cutting tobacco.
2063. S. Cornely, Lime-street—An imp. in the permanent way of railways. (A com.)

Dated 10*th September*, 1859.
2065. H. O. Robinson, Westminster—Imp. in machinery or apparatus for the manufacture of sugar.
2067. J. Pollock, Leeds—Imp. in the manufacture of beds, couches, and invalid or other carriages.

Dated 12*th September*, 1859.
2071. T. G. Gutch, Southampton—The imp. of copying books, for order books and letter books, and so forth, as the imp. can be applied.
2075. F. Heindryckx, Brussels—Imp. applicable to railways or tramways.
2077. F. Versmann and A. Oppenheim, Bury-court, St. Mary Axe—Imp. in the treatment of various substances, so as to render the same non-inflammable.
2079. F. N. Gisborne and L. S. Magnus, 3, Adelaide-place—Imp. in telegraph cables.
2081. H. G. Collins, McLean's-buildings, New-street-square—Imp. in producing printing surfaces on stone, metal, and other materials capable of being employed in printing, in the manner of lithographic stones, also in the production of printing plates and surface printing blocks, and in transfer inks.

Dated 13*th September*, 1859.
2085. G. M. Levi, Val Benoit, Liege, Belgium—Imp. in washing and separating ores and substances of different specific gravities, and in apparatus for that purpose.
2087. J. Grainger, Birmingham—Imp. in breech-loading firearms, and in moulds for making projectiles.
2089. W. E. Newton, 66, Chancery-lane—Improved apparatus for drying paper and other fabrics. (A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette*, *September* 23*rd*, 1859.]

September 22*nd*.
719. J. Davis.
724. J. T. Pitman.
725. E. Maynard.
726. S. Newington.
728. W. P. Wilkins.
731. R. A. Brooman.
732. J. Tyssen.
733. C. A. Watkins.
735. S. Oram.
738. W. Middleship.
740. B. Browne.
742. G. Neal.
746. F. Tillett.
747. W. Garforth & J. Garforth.
748. W. E. Wiley.
750. F. E. Sharp.
752. C. Sanderson.
756. R. Baker.
762. W. Redgrave.
763. E. Steane.
765. M. Frith.
766. G. Naylor.
767. J. C. Evans and P. Soames.
771. J. Buckley, O. Greenhalgh, and R. Hutchinson.
773. C. F. Vesserot.
774. J. Buckingham.
779. C. L. Roberts.
781. J. W. Kelly.
785. R. Searle.
786. Isaac Spight.
787. T. Taylor.
788. H. P. Burt.
789. H. Moss and T. West.
889. J. H. Young.

Patents on which the Stamp Duty of £50 has been paid.

[*From Gazette*, *September* 23*rd*, 1859.]

September 19*th*.
2235. J. Cottrill.
September 20*th*.
2315. P. A. Le Comte de Fontaine-Moreau.
September 21*st*.
2239. W. Beatson.
2251. J. J. Russell and J. B. Howell.

[*From Gazette*, *September* 27*th*, 1859.]

September 24*th*.
2265. D. Law and J. Inglis.

Patents on which the Stamp Duty of £100 has been Paid.

September 23*rd*.
264. A. V. Newton.
September 24*th*.
11. T. W. Gray.
12. T. W. Gray.
70. R. Lakin and W. H. Rhodes.

Journal of the Society of Arts.

FRIDAY, OCTOBER 7, 1859.

CONTRIBUTIONS TO THE HISTORY OF CAST IRON, AND THE NATURE OF ANCIENT IRON SLAGS, ESPECIALLY IN HOLLAND.

By Prof. Dr. S. Bleekrode.

Some inquiries I have made relative to the ancient slags found in the highest district of our country, in Guelderland forest, and covered by the roots of trees, may be prefaced by a a historical review of the invention of melting iron.

It is doubtful whether cast iron was known to the Greeks; the only author who mentions it is Aristotle (Meteorologica, IV., 6). Karsten (Eisenhüttenkunde, 3rd ed. I., p. 12) gives an interpretation of this ambiguous passage. The expressions used by Pliny (Hist. Nat., xxxiv, 39-43) are quite applicable to the process of direct calcining or reducing the ore to spongy iron after the tapping off of the slags. By taking a proper punctuation, different from what is found in our printed editions, his description is quite right. "Mirumque," he says, "cum excoquatur vena, aquae modo liquari, ferrum postea in spongias frangi." That such a method was practised by the Romans, is positively stated by the Austrian geologist, Von Morlot, when describing the remains of Roman iron works at Worhein, near Vitnach, in the Oberkrain; the "fabrica," as it was called by the Romans, lies 4,000 feet above the level of the sea. A large quantity of slags with Roman antiquities have been found there, fibulæ, needles of bronze, onyx, coins from the time of Augustus, 27 B.C., to that of Constantine, 333-35. (Jahrbuch der K. K. Reichs Anstalt zu Wien, 1850, I., s. 199.) The place belongs to the Roman province of Noricum, known by its excellent iron, as mentioned by Ovid—"Durior et ferro, quod Noricus excoquit ignis."

In the history of Siderurgie, scarcely any mention is made of the Chinese. I found in the Dutch translation of the voyage of the Portuguese, Fernando Perez d'Andrade, ed. 1517, that he saw domestic utensils cast of iron, like those which, in his age, were made at Neurenberg from brass; the Chinese utensils, he said, being very fragile, so that by falling they broke to pieces like glass.

In Western Germany and Eastern France the art of casting iron was known before it was introduced in England. In the 15th century such progress was made that a gun could be cast in one piece; until that period they were composed of three parts, and generally there were added twelve or more *culasses* (chambers) as change pieces. This is proved by some of our marine accounts, as preserved in the archives of Leyden. The last gives 1477 by mistake, as the oldest gun of cast iron in Europe was known as that of s'Hertogenbosch, named the "Diablesse" et "Couleuvrine de Bolduc" (Bois le Duc, the French translation of the Dutch name). Its range was extraordinary. It is preserved in that town to the present time. There was engraved on it the date of the year when it was made. Firstly it was said that the year 1411 was inscribed, and this is quoted in several historical introductions to the books on iron metallurgy. From a more accurate examination, however, it appears that it was made in 1511; and that it was forged from malleable iron. The account of the blacksmith who forged it in that year has lately been discovered.

John Owen, in England, who cast guns from gun-metal, is said to have employed cast iron for the same purpose in 1535, and he was followed by Ralph Page, in 1540.

Some mention a Frenchman, Thomas Baudé, as the first who made use of cast iron in England. Notwithstanding this, it appears that the "Blast-furnace" (Hochofen) for pig iron, was quite unknown in England before 1558.

Agricola, who finished his well-known work "De re Metallurgica," in 1550, has not made any mention of pig-iron or cast iron. He speaks only of the "Stück-ofen" as a means for calcination of such iron ores as are too refractory for a direct reduction on the "Rennherd" (ed. 1657, p. 339); he illustrates how the slags are tapped off, and the spongy iron remains in the furnace to be taken out after cooling.

In 1562, there already existed at Rostock (Mecklenburg), an "Ofengiesser." The contract of an "Eisen schmelzer" (iron-founder), Hanz Maltzsch, in 1570, is preserved, and printed, with all its details, in the "Jahrbucher und Jahresbericht des Vereins für Mecklenburgischen Geschichte und Alterthumskunde VII." p. 52 (1842). In this contract, the "first" (as yet known) mention is made of blast-furnaces to cast guns, balls, grenades, furnace pots, ironworks for mills, &c. In the same contract an arrangement was made for recovering the iron from the slags by stamping and washing. Guns were cast from iron in Saxony, in the year 1594. In the Hartz, castings from iron were earlier known. Häckens describes the iron-foundry at the Schulenberg (1572), and speaks of the blast-furnaces, and of iron pots cast by twice molten iron, "Eisenpötte und zwey geschmolzen eisen" (Acta Historico-Chronologico-Mechanica circa Metallurgiam in Hereynia Superiori, auctore Henning Calvör, 1763, II., p. 212).

The casting of iron was introduced into Sweden by a gentleman of Liège, Debesche, who was driven from thence by the religious prosecution of the Huguenots. In connection with this gentleman, our renowned Lodewyk de Geer laid the grand foundation of the Swedish modern iron industry. He (de Geer) developed the trade in weapons to such an extent in Amsterdam that one thousand guns were frequently exported at one time. A large number of men were employed in this industry.

The Dutch likewise introduced the iron industry into Russia. The names of the Dutchmen who, at Kaloega, constructed the first blast furnace (1613), are not forgotten; it was in the time of the Czar Michel Feodorowitz. At Toela, under their direction, were cast the balustrade for the Palace at Moscow, and the plates for the pavement of the Metropolitan Church, before there was a single iron foundry erected in Eastern Germany.

Pig iron from bog iron ore was first made in our country (Holland), in 1689, at Rekhem, in the province of Guelderland, by Josiah Olmius. These iron works were afterwards removed to the present site at Keppel, near Doesborgh. There are now seven or eight blast-furnaces, working bog iron ore in that district, as noted in my chart by blue marks.

It is a remarkable fact that large heaps of slags (noted by red △ marks) have been found underground, covered by peat moss and overgrown by trees of large size, without any historical notice nor any relic of melting works, of furnaces, or of the habitation of man.

Several opinions have been promulgated relative to the origin of these heaps, and it was, in the first place, necessary to demonstrate by chemical analysis, as was easily done, that :—

1. The slags are not remains from volcanic action in the Rhine district—nor similar to the rare mineral from the volcanic island Fayal (The Azores)—called *Fayalit*—nor the *vulcanische eisen-glass* of Klaproth, being a refinery slag, as stated by Prof. Rammelsberg, at Berlin, where the fragment is preserved—nor Thomson's *anhydrous silicate of iron* from the Slavcarragh, in the Morne mountains of Ireland.

2. They are not fragments of a meteorite, although a few years ago a large quantity was forwarded to the Museum at Leyden, with the inscription, "Meteorite fragments." There exists, indeed, an astonishing quantity of meteorites on a large area, the Wolfsmühle, near

Thorn (Prussia), known by the description of Professor Karsten, in 1853 (Berliner Monats-berichte I., p. 30). The chemical constitution of our slags was, however, quite different. The fragments of the Wolfsmühle contained 54·75 per cent. pure iron, without any trace of carbon.

3. They are not from pig iron works or blast-furnaces. The chemical constitution was, as shown by the analysis of the fragments from a heap in the forest, called Onzalige-Bosch, near Arnheim, 80 mètres above the level of the sea:—

Silicic Acid	20·56
Oxide of Iron $Fe\ O$	56·33
Oxide of Iron Fe_2O_3	10·30
Alumina Al_2O_3	3·45
Oxide of Calcium $Ca\ O$	0·49
Oxide of Magnesium $Mg\ O$	0·33
Kali	0·67
Oxide of Manganese	0·10
Sulphur and Soda	traces.
Phosphoric Acid	nihil.

The comparison of the analysis from the different heaps, together clearly demonstrates that they are silicates of iron-oxide under the form of $3\ Fe\ O,\ Si\ O_3$, with a variable quantity of iron-oxide Fe_2O_3 from the decomposition and the incomplete process of reduction of the ores. The variation of the constituents is as follows:—

Silicic Acid,	maximum	31·80	minimum	23·63
Oxide of Iron, $F_2\ O$	,,	62·10	,,	46·62
Oxide of Iron, $Fe_2\ O_3$	,,	26·00	,,	9·30
Oxide of Manganese	,,	1·00	,,	0·01
Alumina,	,,	3·45	,,	0·10
Oxyde of Calcium,	,,	2·00	,,	0·00

The slags contain a small quantity of alumina and the constituents of wood-ash. It is clearly demonstrated that they are not from a process where limestone is employed. They contain not a vestige of iron as regulus; a few particles of the powder are attracted by the magnet; the mass shows an attractive power on the magnetic-needle. The specif. gr. = 3·4. They resemble the slags dropping from the reverberatory furnaces for converting old or scrap-iron into forgings (*fer ramassé*), covered by the vermiculated traces of the drops, so that the farmers supposed the stones were petrified worms or snails. There are several distinct layers of the vermiculated traces in the fragments. The slags are molten easily in the reverberatory furnace as mentioned above. Their fusibility does not differ from these slags. The slags of these furnaces show the same composition:—

Slags of the reverberatory furnace for forgings—

	at Leyden.	at Delft.
Silicic Acid	25·09	29·50
Iron-oxide, $F_2\ O$	58·50	54·90
Iron-oxide, $Fe_2\ O_3$	16·50	15·25
Calcium-oxide	0·22	,,
Magnesia	0·06	,,

In several places heaps of charcoal were discovered. Under them I found a small piece of roasted bog-iron ore, with an external crust of slag. Its composition was hydrated iron-oxide 89·85, and 7·42 of silicate. At other places the charcoal was quite decayed to a black powder, and is employed by the farmers as a black dye (*noir de fumée*). In some places this black earth and charcoal powder are famed as fertilizers.*

A good deal was said of ashes to be found in the vicinity of the heaps, under and between the fragments of slags. Such a phenomenon was quite inconsistent with any process of iron manufacture. Indeed, the analysis of all that was called ashes, showed that the name only originated from the appearance; really they are diluvial sands of quartz mixed with some humus from decomposed heath and mosses. The maximum of humic substances and water was 6·70; and the minimum of insoluble sand 86·20. It was, therefore, by mistake that this grey coloured sand was called ashes.

A few small fragments of the supposed furnaces were found between the slags. These were made from diluvial sand mixed with loam. The loam was burnt to a red colour, the sand only agglutinated.

One piece of forged iron only up to this time has been found, and it is now preserved in the Archæological Museum at Leyden; antiquarians suppose that it belongs to an arch. My drawing shows it in the natural size.

Coins have not been found amidst the slags. Fragments of hand millstones from the basalt-lava of Andernach; fragments of very rude earthenware (supposed by our antiquarians to be of the Carlovingian age) and bones of calves and pigs have been collected from a heap of slags, called the Iron Mountain (Yzeren Berg). There are heaps containing several hundred loads.

The phenomenon of slag-heaps is not an exceptional one to this country. Finland, and Sweden, and Norway, as described by Ole Evenstad; the Roman and Danish cinders of the Forest of Dean (Scrivenor, "History of the Iron Trade," p. 29); the iron scoriæ of Loch Goil, described by John T. T. Kyle (British Association, at Dublin, 1857); slags in the vicinity of Rouen, Dieppe, St. Amand, and elsewhere in France, examined by Berthier; the schlacken-halde of Silesia, overgrown by trees of six centuries old; "Le Champ parsémé de Scories," near Bofor, in Luxemburg, &c., &c., altogether of the same nature and chemical constitution, being silicates of iron oxides, prove clearly that the iron manufacture, direct from the ores was once generally practised in Europe, where wood and easily reducible iron ores were found. In our country, the bog iron ore was found in the vicinity of the forests, and at no great distances from the localities where the heaps of slags have been detected. Our present bog iron ores contains iron regulus 41·14 to 52·81, under the form of yellow hydrated iron-oxide mixed with diluvial quartz sand and humus.

For illustrating the simple method of the ancient process of reducing iron direct from its ores, I have in another place given a description of that now employed by the natives of Borneo, Blitong producing the steel-iron, called "pamor," of their excellent arms and guns, not different in quality from Indian "wootz." Pure oxides or hydrated oxides of iron, without lime, easily fusible at a low temperature, and charcoal or wood as fuel, are the conditions under which this process succeeds perfectly. The influence of lime on the fusibility of the slags was proved by the process of making forgings in the reverberatory furnaces at Leyden and Delft. The operation has not succeeded when using sand from the coast of Scheveningen, where the sand of the downs contains nearly 3·20 carbonate of lime, from small particles of shells—but very well when employing the pure sand of the Helder, being 99·574 per cent. pure quartz.

There can be no doubt, that for manufacturing cheap malleable iron from all sorts of iron ores, the intermediate process for pig iron is wanted; however, it cannot be denied that quantity and cheap production are gained at the expense of quality. Hence we see, that during the last years, many trials have been undertaken to modernise the method for reducing malleable iron from its ores direct. I may mention for example:—Heath's process for the Madras iron (1849); Winkler, in Silesia (1842), and Thoma, in Moravia (*Berg-und Hütten Münnische Zeitung*, 1843, p. 241, 577; 1845, p. 161; 1848, 58); the trials by the order of the Oberste Bergwernbehörde, at Vienna, undertaken by Von Gersdorff and Hampe, at Neuberg; the late Ad.

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* At one place the ground covering the slags contained nearly 64·25 per cent. peat substances. It is a remarkable phenomenon, as was already noticed by Wallerius, relative to Sweden and Norway, that the slag-heaps were overgrown by the largest trees. He supposed that iron was a compound of an argillaceous substance, so that the slags, by their decomposition, produced a fertile ground.—(*Systema Mineralogicum*, II., p. 268).

Chenot, who received a medal of honour at the Paris exhibition for, "Cette perfection exceptionnelle due à la science et au travail," called by the celebrated Professor Leplay[*], the greatest siderurgical progress of our age; and last of all, James Renton's patent, carried into operation in the new world, at Cincinnati, by the firm Davis and Co., by the Harvey Steel and Iron Company, at Motthaven, near New York, as mentioned by Professor Wilson, in his admirable report on the New York Exhibition. The new process, called by the German siderurgists "Erzpudeln" (ore-puddling) by gas, as described by Mr. Thoma Gashüttenman, at Suhl, in Thuringia (Berg-und Hüttermänn Zeitung, 1856, No. 22), is perhaps the commencement of a new era to restore the primeval and semi-civilised method of manufacturing pure iron direct from its ores,

All the slags, refinery, puddling, tap-cinders, mill-furnace, from the forges, catalans, &c., of the typical constitution, 3 Fe O, Si O_3, or silicate of protoxide of iron, are properly rich iron ores, containing 69·53 iron oxides, or 53·97 iron regulus. A question has been mooted whether our ancient slags are of any value. To answer this, I give a concise history of the propositions made for the utilisation of slags. Berthier was the first (*Journal des Mines*, tom. xxiii. p. 177, et xxvii. p. 193; *Annales des Mines*, ser. 1e, tom. vii. p. 377).—"Les scories des anciens," he says, "pourraient aussi être traitées au haut-fourneau avec beaucoup de profit, puisque leur produit moyen serait d'à-peu-près 45 pour cent de fonte. Leur abondance est telle dans les lieux où elles se trouvent, qu'elles dispenseraient pendant longtems d'emloyer du minerai, &c." A. N. S. Arndtz published, in 1829, a notice, to show how the slags and scoriæ could be employed for the production of iron (Kunst und Gewerbeblatt für Bayern, 1829, p. 265). In Sweden the slags are generally utilised for iron in a special furnace, called a "stücköfen," as advised by Sefström, in 1821, and described by Durocher, who visited the iron districts of Sweden and Norway in 1855-56 (*Annales des Mines*, 1856, xi., p. 497.)

What is recommended in the works on iron by Flachat, Barruel, and Petier (i. p. 28), saying, relative to these slags:—"Comme des minerais artificiels sont riches, susceptibles de rendre 40 à 60 de fonte, leur exploitations étant d'autant plus avantageuses qu'elles sont plus pures," has been practised in several iron-works on the Continent. At Liège (Seraing) commonly 28 to 30 per cent. slags and scoriæ are mixed with the poorer clay and zinc-iron ores, producing by the high-blast furnace 43 pig-iron. In 1855, all the refinery slags from the Alvensleben-hütten, in Silesia, have been melted in the high-blast furnaces of the Königshütte, by mixing them with 35 per cent. limestone, and 14 per cent. schieferthon (argillaceous schist); this succeeded likewise in 1856. In Austria the slags have been mixed with iron ores, &c. (Oesterreichishe Zeitschrift fur Berg und Huttenweser, 1855, Nos. 39 et 50).

The ancient slags of the Forest of Dean were melted for iron in the first iron-works, as mentioned by Henry Powle, in the "Philosophical Transactions," 1678, No. 137, p. 931. They were likewise transported to Bristol, for the manufacture of well-known black bottles, as recently stated by Mr. Watson, in the "Geologist." In 1846, Dr. John Percy, in his admirable report on the crystalline slags ("British Association Transactions," p. 351), observed:—"An immense quantity of iron slag, far richer than many iron ores, is annually thrown away, and it may be that the presence of phosphorus in sensible quantity is one of the causes which prevents the re-melting of this slag with advantage. This fact has not yet sufficiently attracted the attention of those engaged in the manufacture of iron. The discovery of a method of extracting economically good iron from these rich slags would be of great advantage to the country, and could not fail amply to reward its author." Hence, we may conclude that the methods, as described in the patents of Anthony Hill (1814), David Mushet (1815 and 1822), T. T. Dawes (1833) were not tried, or were not successful. In 1854, Professor F. Crace Calvert took out a patent for the treatment of iron slags or cinders, by calcining and mixing them with 50 per cent. slacked lime (Specification printed No., 1815) and, in 1855, another patent for the same subject, the proportions being changed to 15 to 20 per cent. quick lime, or 20 to 30 slacked lime, or 25 to 50 limestone. (Specification printed, No. 1975.) To conclude, that the slags as mentioned can be remelted into iron is sufficiently proved by the success at several iron works on the continent. In England also, as kindly communicated to me by Dr. Percy, the refinery slags, cinders, and mill furnace slags, have all been worked up in the blast furnaces during the last few years.

Their special application for providing a material for puddling furnace bottoms (the patent of Bradley, Burrows, and Hall, 1838) and their employment on account of their solvent action for the reduction of copper seyds, require no explanation. Our ancient slags have been employed in copper works, and for making roads.

METROPOLITAN BOARD OF WORKS.

The annual report of the Metropolitan Board of Works has just been published as a parliamentary paper, and contains an elaborate account of their proceedings during the past year. In detailing the steps they have taken with reference to one of the most important subjects which have engaged their attention, namely, the main drainage of the metropolis, they revert to the transactions which occurred in connexion with this question shortly before the close of the period comprised in their last report, in which, however, it is hardly necessary to follow them. The powers conferred upon the board by the bill for amending the Metropolis Local Management Act, which became law on the 2nd August, 1858, are referred to. It empowers the board to raise a sum not exceeding £3,000,000 for the purposes of the main drainage, and enable them to raise in each year, during forty years from its passing, a sum equivalent to a rate of 3d. in the pound on the annual value of the property rateable, estimated according to the basis for the county rate. The day after the passing of this act the board met for the consideration of the important works to which it was mainly directed; and referred the plans which had been submitted to the First Commissioner of her Majesty's Works to a committee who brought up a report on the 11th of the same month, and the board came to resolutions affirming the principles of drainage recommended. The following is a summary of these works. They consist of a system of intercepting sewers on each side of the Thames, making a total length of 72 miles, comprising, on the north of the river, a high level, middle level, low level, and outfall sewer, with sewers for draining the low lying area included in the extreme western portion of the metropolis. The works on the south of the river consist of a high level, low level, and outfall sewer. There will be reservoirs at the outlets, and at certain points pumping engines and machinery for lifting the sewage of the low-lying districts. The high-level sewer north of the Thames extends from the river Lea, near Old Ford, passing thence in a general westerly direction under Duckett's canal, and the North London Railway, to Stoke Newington, where it is carried under the Great Northern Railway, proceeding thence to the existing line of the Fleet Sewer, in Mansfield-road, Gospel-oak-fields, near the foot of Hampstead-hill; the size of the sewer at the Lea will be 9 feet 6 inches in height by 12 feet in width, and at the upper end it will consist of a 4-feet barrel; its length being 7¼ miles. The middle-level sewer, on the north of the Thames, will be 9½ miles in length, and it forms a junction with the high-level sewer at Old Ford, passing under the Regent's canal, and proceeding through Bethnal-green-road, Clerkenwell, and other places towards the west, till it reaches the Counter's-creek sewer, near the Great Western Railway, at Kensal-green. Its dimensions at the lower end will be 9 feet 6 inches in height by 12 feet in width, and at the upper end 4 feet 6 inches in height by 3 feet in width. In its course it will receive the Coppice-row and Piccadilly branches. The above sewers will discharge by gravitation. The low-level sewer will extend from the lift at the outfall sewer at Abbey Mills, in the Essex Marshes, where its contents will be raised by steam power into the outfall sewer, and where it is proposed to construct a pumping station. From this point it will pass in a westerly direction under the river Lea, and under the Dock Railway, the Regent's canal, and Blackwall Railway, to Tower-hill, and thence to a point near Blackfriars-bridge. Its further course from this point until its junction with the Ranelagh Sewer at Chelsea will depend on the arrangements which may be made for constructing a Thames embankment, by which it will be determined whether the sewer must be carried along some of the main thoroughfares of the metropolis, or whether it can be constructed in conjunction with an embankment in close proximity to the river. The position of the board with respect to the embankment of the Thames is clearly described in their proceedings on the 29th June in last year, where, after premising that the engineers, Messrs. Bidder, Hawksley, and Bazalgette, had recommended that the low-level sewer on the north of the river should be carried in an embankment between Westminster and London bridges, in order to avoid damage to property in the leading thoroughfares, and other injurious consequences, the board declared themselves willing to pay for a part of the Thames embankment, in such proportion as the drainage might be fairly debited with, or undertake the construction of the embankment of that part of the river for drainage and other purposes upon a contribution by the government. At the lower end the low-level sewer will be a 9-feet barrel, and at its upper extremity 4 feet in height by 2 feet 8 inches in width. It will in its course receive three branches, namely, the Hackney Brook, the Isle of Dogs, and Penitentiary branches. The high and middle level sewers near Old Ford are provided with a weir or overflow chamber, and two parallel lines of culverts at a low level for the discharge of storm waters. The outfall sewer will extend from a point near the south of the River Roding, in the county of Essex, across the marshes, through East Ham, and other places, to the River Lea, over which it is carried, and then effects a junction with the high and middle level sewers. Between this junction and the pumping station at Abbey Mills, it will consist of two parallel culverts, each 9 feet in height and 9 feet in width, and eastward from the pumping station, it will consist of three parallel culverts, each 9 feet in height by 9 feet in width; it will be $5\frac{1}{4}$ miles in length, and throughout a considerable portion of its course will be constructed in an embankment. The sewer for the western area of the metropolis will drain to a pumping station near Fulham Fields, where the sewage is intended to be deodorised. The main line will extend from Sandsend-lane to the outlet of the Stamford Brook, near Hammersmith Creek. It will vary from a 4-feet barrel to a sewer 3 feet 9 inches by 2 feet 6 inches, and will be $2\frac{3}{4}$ miles long. In its course it will receive a branch from Fulham, the Cheyne-walk branch, the existing Counter's Creek sewer, and the Acton line of sewer. In December last the board contracted with Mr. William Moxon, of Dover, for the execution of the necessary works, at the sum of £152,430. The works were begun on Hackney-common, on the 31st of January, and their progress was at first considerably retarded by the difficulty of obtaining possession of certain land belonging to private parties. On the 4th of March the line of cutting had been opened for a length of 1,100 feet, 10,000 cubic yards of earthwork removed, 200 feet of sewer, 10 feet 9 inches by 10 feet, had been completed, another 160 feet of invert and side walls built, and a further length of 120 feet of invert laid in. The board, on the 22nd of July, accepted the tender of Messrs. Helling and Co. for the construction of the high level sewer, south of the Thames, for the sum of £217,000, and at the date of the report it was hoped the works would shortly be commenced. A tender had also been accepted for a further portion of the works known as the Acton Branch of the Western Sewers. The plans and specification of the middle level sewer were in a forward state, and it was expected that the whole of the works will have been commenced in the early part of the ensuing year. The works which have been executed, and were in course of construction in connexion with the Northern High Level Sewer, on the 30th of July, extend from the River Lee at Old Ford, Bow, to the Darnley-road, Paradise-place, and Albion-road, in the parish of Hackney.

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[*] This process is improved by P. d'Agimont, in Belgium, and now practised by a Company at Charleroi.

The board next refer to the efforts made to provide funds for the execution of the works, which resulted in an arrangement with the Bank of England for the advance to the board of £3,000,000 between the date of the agreement and the 31st December, 1864; that repayment should be made by annual instalments, being the produce of the main drainage rate of 3d. in the pound on the metropolis, assessed on the county-rate basis, after providing for the interest on bonds, the Bank accepting as security for their advances bonds issued by the board, guaranteed by the Lords Commissioners of the Treasury, bearing interest at the rate of $3\frac{3}{4}$ per cent.

The works executed by the board during the year ending March 25, comprise various lengths of new sewers, making a total of 6,981 feet, 34 side entrances, 60 ventilating shafts, and a number of junctions, flaps, and gullies. The total cost of these, with that of the cleansing of 166 miles of main sewers, repairs, and the deodorisation of the sewage in main lines, with other incidental works, make the total expenditure on sewerage works £46,302 9s. $8\frac{1}{2}$d. This expenditure is exclusive of the sums paid for salaries and wages for attending the flaps and outlets of the main sewers. Plans for the construction of 34 miles 4,271 feet of sewers had been submitted to the board by various vestries and district boards. These plans had been examined and approved. Some of the proposed works had been modified, in accordance with the directions of the board, and care had been taken to ascertain that the whole of them were of such a character as to render them constituent portions of a comprehensive system of general metropolitan drainage.

Under the 183rd section of the Metropolis Local Management Act five applications have been made to the board by vestries and district boards for permission to borrow, on the security of rates leviable within their respective jurisdiction, various sums amounting in the whole to £34,600. The board, after preliminary inquiry into the necessity for and the efficiency and cost of the works, granted their sanction for loans of specified amounts.

The board, in June last year, having had their attention drawn to the importance of measures for abating, as far as practicable, the nuisance arising from the offensive condition of the Thames, caused the contents of the principal sewers to be deodorised at their outlets. The cost of these operations, which were attended with perceptible benefit, was about £3,430. For the purpose of determining upon the best means of deodorising or otherwise dealing with the sewage at the outlets of the western area, and at other points, the board have given instructions for an inquiry into and examination of the various schemes proposed for the deodorisation and disposal of sewage matter, and for neutralising the noxious properties of sewage. This investigation they have confided to the eminent chemists, Dr. Hofmann and Dr. Frankland, who at the date of the last report were engaged in testing the merits of the schemes brought to the notice of the board.

At the date of the last report the board had taken steps for obtaining the funds requisite to enable them to proceed with the purchase of the property required for the formation of the new streets in Southwark, and near Covent-garden. A committee of the whole board had, up to the 25th March last, dealt with claims amounting to £117,093 5s. 1d. on freehold and leasehold interests, goodwills, losses on removals, &c., in regard to the Covent-garden approach, which had been settled for the sum of £80,178 14s. 8d. In the same manner the board have adjusted and settled 109 claims regarding property and interests required in opening up the Southwark and Westminster communication. These claims amounted to £143,161 11s. 10d., and were settled for the sum of £111,855 14s. 8d., when the amount of the claim and the settlement have nearly coincided.

Notices have also been served, and other steps taken, for carring into effect the powers obtained for opening up a direct line of thoroughfare extending from the junction of the East and West India Dock roads to Victoria-park, so as to render that place available to a much larger section of the inhabitants of the eastern portion of the metropolis than is now the case. The board, on the 19th November, 1858, contracted with the Clergy Mutual Assurance Society for a loan of £42,000 for effecting the improvement.

The vast importance of opening these and other new thoroughfares, to relieve the overcrowded streets of the metropolis, has been for a long period under the anxious consideration of this board, who have had a comprehensive scheme prepared of the various improvements that appear most needed at the present time, accompanied with a map of London, showing such improvements, together with a report and approximate estimate of the cost of effecting them. One of the more prominent of these improvements is the amelioration of the gradients of Holborn-hill and Skinner-street; and the board have examined into several of the plans that have been proposed for attaining this object.

One of the most remarkable of these plans is that devised by the architect of the board, by which it is proposed to set back the frontages of the houses on the north side of Holborn-hill and Skinner-street about sixty feet from the present line of buildings, so as to obtain sufficient space for the construction of a high-level road, extending from Hatton-garden to St. Sepulchre's church, with a viaduct of one arch, spanning Victoria-street. Some alteration in the present level of Victoria-street would be effected, by means of which the traffic of that street would be connected with the east and west traffic, passing along the viaduct or high-level road. Victoria-street being at present, for the most part, unbuilt upon, these alterations of level can be effected without difficulty, and are included in the present scheme.

In many parts of the metropolis the local authorities have directed their attention to the promotion of improvements in their parishes, by widening streets and roads, and preserving open spaces, and in various cases contributions to the extent of one-third have been made by the board towards these objects.

The applications for the approval by the board of the laying out of ground in the formation of new streets under the bye-law of the board, have amounted to 61 during the year; of these, 53 were granted, five were refused, and three are pending.

The rules of the Building Act for the construction of buildings are enforced by the supervision of 56 district surveyors, subject to the appointment and control of this board. These surveyors make monthly returns of all notices and complaints, works supervised, and fees charged and received within their respective districts. These returns are required by the statute to be examined and audited in the office of the superintending architect; and from the annual abstract and report, it appears that during the years ending 31st December, 1858, fees to the amount of £21,732 were received by district surveyors in respect of 15,500 works supervised; and that the expenses of their offices, which they are required to keep, were £4,632. The works and fees included in the returns of 1858 exceed 50,000 entries. From these returns it also appears that the probable number of new buildings erected within the metropolis during the last three years exceeds 20,000, exclusive of additions to buildings.

Between the 25th March, 1858, and the 25th March, 1859, the receipts of the board amounted to £159,886 4s. 7d., and their payments to £185,290 16s. 11d. The monies owing to the board on the 25th March, 1859, in respect of assessments by precepts on vestries and district boards, outstanding amount of improvement rates, contributions to sewerage works, &c., was £98,784 14s. 2d. Besides this, they had a general cash balance in hand of £28,998 12s. 6d., and also the sum of £15,881 16s., invested in New Three per Cents., for the repayment of mortgage debts. Their debts and liabilities at the same date, including the amount of the mortgage debts and other special liabilities of the former Metropolitan Commissions of Sewers, amounted to £458,048 7s. 1d. The above is exclusive of the monies received and expended in respect of the Covent-garden approach, Southwark, and Westminster communication, and Victoria-park approach improvements.

The board, finding their present premises in Greek-street insufficient for the transaction of their business, found it necessary to seek another situation for the erection of offices, which they had found in the site of Berkeley-house, Spring-gardens. They purchased the existing lease for the sum of £500, entered into an agreement with the Commissioners of her Majesty's Woods and Forests, for the grant of a new lease for 99 years, at a rent of £500 a year until the 10th October, 1871, and of £350 during the remainder of the term, and had accepted a tender of Mr. George Myers for the execution of the requisite works for the sum of £14,829, and the building is now in course of erection. The execution of these works will be attended with the advantage of effecting a great public improvement, by throwing an additional width of 13 feet into the existing narrow entrance into St. James's Park, by which means the width of the passage will be increased from 8 feet 6 inches to 21 feet 6 inches.

The board, in the course of the year's proceedings which formed the subject of their last report, instructed a committee of their body to prepare a draft bill, embodying such alterations in the existing law as they should consider requisite and proper for facilitating the proceedings of the board, as well as of vestries and district boards, in the execution of the Metropolis Local Management Act, and a draft bill was prepared in accordance with that instruction. The amendments proposed involved so many grave questions affecting the pecuniary obligations of the various parishes of the metropolis, and other important matters, that the board are compelled to postpone the introduction of a comprehensive measure to a future period. During the past year, they have continued to experience considerable difficulty in the conduct of their proceedings, in consequence of the dissatisfaction felt by many of the local boards at the apportionment of the former debts of the Metropolitan Sewers Commissions, effected by the act of 1855; and for the purpose, if possible, of putting an end to these embarrassing questions, the board decided on preparing such an adjustment of their debts as they might deem equitable and just, and embodying them in a bill to be presented to parliament for its sanction in the present session. Accordingly, on the 11th December last, they decided on seeking statutory powers to re-apportion the debt in respect of the £200,000 borrowed from the Rock Life-office, according to the degree of benefit accruing to each parish from the works executed. The settlement of questions so closely affecting the financial position of the great bulk of the metropolitan parishes, as was necessarily to be anticipated, was a work of labour and time, and proved the subject of much diversity of opinion. A bill directed to the objects stated at the time of the issuing of the report had been prepared by the committee, and approved by the board, but it was extremely doubtful whether it would be practicable to introduce it into the House of Commons during the last session.

BRITISH ASSOCIATION, ABERDEEN, 1859.

CONDENSED ABSTRACT OF A FIRST SET OF EXPERIMENTS, BY MESSRS. ROBERT NAPIER AND SONS, ON THE STRENGTH OF WROUGHT IRON AND STEEL.

Communicated by W. J. Macquorn Rankine, C.E., LL.D., F.R.S.S., L. & E.

The following paper was read before the Mechanical Section:—

The experiments to which this abstract relates form the first set of a long series now in progress by Messrs. Robert Napier and Sons, the details being conducted by their assistant, Mr. Kirkealdy. The whole results are now in the course of being printed *in extenso*, for publication in the "Transactions of the Institution of Engineers in Scotland;" but some time must elapse before they can appear, owing to the great volume of the tables, and the number of particulars which they give.

The present abstract is all that it has been found practicable to prepare in time for the meeting of the British Association, and, notwithstanding its brevity and extreme condensation, it is believed that the results which it shows will be found of interest and importance. It gives the tenacity, and the ultimate extension when, on the point of being torn asunder, of the *strongest* and the *weakest* kinds of iron and steel from each of the districts mentioned. Each result is the mean of four experiments at least, and sometimes of many more.

The detailed tables, now being printed, will show many more particulars, and especially the contraction of the bars in transverse area along their length generally, owing to "drawing out," and the still greater contraction at the point of fracture. The experiments now complete were all made with loads applied gradually. Experiments on the effect of suddenly applied loads are in progress.

Table A.—Iron Bars.

	Tenacity in lbs. per sq. inch.	Ultimate extension in decimals of length.
Yorkshire: strongest	62886	0·256
,, weakest	60075	0·205
,, (forged)	66392	0·202
Staffordshire; strongest	62231	0·222
,, weakest	56715	0·225
West of Scotland: strongest	64795	0·173
,, weakest	56655	0·191
Sweden: strongest	48232	0·264
,, weakest	47855	0·278
Russia: strongest	56805	0·153
,, weakest	49564	0·133

Table B.—Iron Plates.

	Tenacity in lbs. per sq. inch.	Ultimate extension in decimals of length.
Yorkshire; strongest lengthwise	56005	0·141
,, weakest lengthwise	52000	0·131
,, strongest crosswise	50515	0·093
,, weakest crosswise	46221	0·076

Note.—The strongest lengthwise is the weakest crosswise and *vice versâ*.

Table C.—Steel Bars.

	Tenacity in lbs. per sq. inch.	Ultimate extension in decimals of length.
Steel for tools, rivets, &c.: strongest	132909	0·054
,, weakest	101151	0·108
Steel for other purposes: strongest	92015	0·153
,, weakest	71486	

Table D.—Steel Plates.

	Tenacity in lbs. per sq. inch.	Ultimate extension in decimals of length.
Strongest lengthwise	94289	0·0571
Weakest lengthwise	95594	0·1986
Strongest crosswise	96308	0·0964
Weakest crosswise	69016	0·1964

Note.—The strongest and weakest lengthwise are also respectively the strongest and weakest crosswise.

LECTURES ON SOCIAL SCIENCE.

A course of six lectures on this important subject, embracing all the relations between Labour and Capital, is about to be delivered by Mr. William Ellis, under the authority of the Committee on Education, at the South Kensington Museum. These lectures are particularly addressed to school teachers, but the general public will be admitted as far as there may be room in the theatre. The first will be given on Tuesday, 11th October, and they will be continued on each succeeding Tuesday.

THE DISCOVERY OF COAL IN KENT.

In accordance with the arrangement made at the last meeting of the East Kent Natural History Society, the Rev. B. S. Malden and Mr. A. B. Andrews visited Lydden yesterday for the purpose of ascertaining the facts with reference to the alleged discovery of coal. It appears that the substance found is in reality coal, though its occurrence in the position in which it lay is difficult to explain. The workmen engaged in executing Lydden tunnel found embedded in the chalk, at a depth of 180 feet, a mass of coal weighing about 4 cwt. With the exception of this lump no other coal has been seen. In their walk through the tunnel the visitors saw great numbers of flints in the chalk, and also veins of clay and apparent faults in the formation, but where the coal was found there was nothing of the kind. The chalk here was solid, without fault or fissure. The coal is bituminous, containing veins of ferruginous clay. Mr. Malden having applied a lens, it took fire in a short time. The visitors brought away a specimen, weighing about 3 lbs., which Mr. Walker, the sub-contractor, courteously caused to be sawn off, and which the East Kent Natural History Society will present to the Canterbury Museum. The discovery of coal under the circumstances described is, we believe, extremely unusual.—*Kentish Gazette.*

Home Correspondence.

KEW GARDENS.

Sir,—I read with much interest, in the last *Journal*, the report of Sir William Hooker on Kew Gardens. It is satisfactory to observe how steady has been their development, and how increasingly useful they are likely to become. There are, however, two or three lines in the report which call attention to the fact that the gardens are not open before one o'clock in the day, and an attempt is made to justify the exclusion of the public till that hour. Having experienced the inconvenience, and suffered loss of time from this arrangement, I should be glad to know if the museum, which for commercial purposes is of great value, is closed up to one o'clock during the short days of the winter months, as well as during the summer.

I can see good reason for closing the plant-houses in the gardens during the winter; but I cannot understand why the museum should be closed at any period of the year, nor why persons in business, and having little time at their disposal, should be excluded from the possibility of using the collection for reference, unless they can give up time in the middle of the day.

I had occasion to visit the museum about a fortnight ago, and believing that it, like most other Government museums, was opened at ten o'clock, I took an early train to Kew, intending to return to business by mid-day. Much to my annoyance, I was obliged to remain till one o'clock before I could even get into the grounds. It may have been a judicious arrangement formerly, when Kew Gardens were half-a-day's journey from London, but now that two or three railways run their trains regularly from an early hour in the morning, and steam-boats ply constantly from London-bridge to Kew, it cannot be urged that the public could not take advantage of an earlier hour of opening. In the interest of commercial men, by whom the museum may be largely used, I trust that arrangements will be made by which the museum, if not the grounds generally, will in future be opened at ten o'clock in the morning, at latest, and thus increase its usefulness, and at the same time economise the time of men in business.

If this cannot be accomplished so long as the museum is retained at Kew, I would suggest that the Society would do good service if it could get up a discussion, and urge upon Government the desirability of combining, for commercial purposes, under one roof, the Animal collection at Brompton, the Vegetable collection at Kew, and the Mineral museum in Jermyn-street. It would be a far more natural arrangement to have the specimens illustrative of the uses to which the products of the three kingdoms of nature are applied exhibited under one roof, and the economy in so collecting, arranging, and exhibiting the specimens would be great, as many duplicates could be dispensed with, and a smaller number of attendants would be required. If this suggestion could be carried out, and the advantages of an evening exhibition (as is at present the case only at Brompton) could be effected, great public good would result in an educational point of view. I am, &c.,

H. G. HAWARD.

Bow.

Sir,—Notwithstanding the correct statements which you have been so good as to give in your columns from time to time in reference to the closing of the pleasure-ground portion of the Royal Gardens for the winter season, and though notices are duly posted in the gardens, where they can be read by the immense concourse of visitors who resort thither (more than 400,000 annually), all announcing the closing of the pleasure-grounds on the last day of September, these statements have often been construed into a closing of the entire establishment, which has never been contemplated.

The Botanic Garden constitutes one portion of the Royal grounds of Kew. It comprises seventy-five acres: includes all the plant-houses, and is separated by a light wire fence from the pleasure-grounds. It is accessible to the public every day (Good Friday alone excepted), from one o'clock (two o'clock on Sundays) till sunset, throughout the year.

The pleasure-ground is an adjacent part of the demesne—a richly-wooded park, bordered on one side by the Thames, consisting of nearly 250 acres, and now, by recent planting, constituting a noble *arboretum* of all trees and shrubs that will bear our favoured climate, and intersected with extensive and well-kept walks. A lake of five acres, with islands, is forming, and a new conservatory, or winter garden, of unprecedented size, for tender trees and shrubs (rhododendrons, camellias, &c.), is sanctioned and provided for by the Crown. This building will be erected by Mr. Decimus Burton, the architect of the palm-house, and is to be commenced forthwith. This fine piece of ground, possessing no particular attraction in winter, nor much shelter in bad weather, has not hitherto warranted the cost of gate-keepers, &c., necessary for the admission of visitors at that season. The expressed wish of the public has, however, been considered by the First Commissioner of Works, and I am instructed by that gentleman to keep open the pleasure-grounds during the present month of October.—I am, &c.,

WILLIAM J. HOOKER, Director.

Royal Gardens, Kew, W., Oct. 1.

P.S. — There are three entrances to the pleasure-grounds from the public road; first, by the Brentford-gate; second and third, by the Lion and Unicorn Gates, on the Richmond-road. The entrance to the Botanic Garden is open daily; and during the period when the public have access to the pleasure-grounds there are communications by four gates between these grounds and the Botanic Garden.

TO THE EDITOR OF THE TIMES.

Sir,—Observing in *The Times* of to-day a letter from the director of the Gardens at Kew, which, to those unacquainted with the hours of admission and closing, is calculated to lead to disappointment, I beg space to make a few observations thereon.

The letter correctly states that the hours for admission to the Botanic Garden are, 1 o'clock on week-days, 2 o'clock on Sundays; but states no time at which the pleasure-ground is open, thus leaving a stranger to infer, as he naturally would, that the pleasure-ground is open for the entire day, which certainly might and ought to be the case if the public advantage were consulted. Why should not these public gardens, as are those on the Continent, be open at all reasonable hours.

The impression in this neighbourhood is that it is in order to keep these Gardens for the exclusive use of some of the favoured residents at Kew that they are kept closed to the public during the forenoon of the day.

These Gardens are maintained at the public expense, and the public, I venture to think, are entitled to all the benefit they are calculated to afford; and should not be, as at present, excluded during the best part of the day —viz., the whole of the forenoon.

May I be allowed to suggest further, that when the hour for closing arrives, the public be apprised thereof by a bell placed in a central situation in the Gardens, and not, as at present, have their ears rudely assailed by being bawled at by "All out," in the most vulgar and unceremonious manner conceivable.

Begging that you will be good enough to give this letter insertion, I am, &c.,

PATERFAMILIAS.

Brentford, Oct. 4.

THE WESTMINSTER BELL.

Sir,—The great bell of the Clock Tower has again been broken. This has resulted from the use of a much larger hammer, for the weight of the bell, than the usual proportion, and the employment of so great a quantity of tin in the composition as to render it unusually brittle. For this disaster, as well as for the former one, Mr. Denison is entirely responsible.

After the confirmation of the views concerning the enormously disproportionate force of the first hammer which I published some months before the first bell was broken, others have shared the opinion that the second bell would meet the same fate as the first.

I may particularly mention Mr. Quarm, as having expressed his conviction to that effect; and Mr. James, as having proved the extreme brittleness of the metal, by breaking three small bells, made from the same composition, with very light blows, in Mr. Denison's presence, at Messrs. Mears's foundry. Surely Mr. Denison's career as bell founder and clockmaker, under the sanction of government will now come to an end, for it has resulted in more failures and brought greater discredit on the arts of bell foundry and clock making than we otherwise find recorded in this country during the last century.

I am, &c., E. T. LOSEBY.

Oct. 1.

Sir,—Since the above letter was written, an account has been published, in which the cause of the fracture is ascribed to the bell having been tightly screwed up to the frame, without the possibility of motion when it was struck. This is erroneous, as I noticed the bell whilst sounding the hour on Wednesday last, and observed it to recede at least three-quarters of an inch from one of the blows; and it must moreover be remembered that where clock hammers are used on swinging bells, they are placed at a right angle to the plane in which the bell swings, and that they cannot therefore recede from the blow beyond the small quantity which the beam and other parts bend, and which altogether does not generally amount to one-quarter the space through which the present bell receded. At the same time there is no doubt but that the larger the bell the greater distance it should be allowed to play; not only to guard against fracture, but to permit the hammer to follow it up and remain in contact long enough to overcome the inertia of the mass, and set the entire bell in sonorous vibration.

In order to carry out these views, Mr. Quarm proposed that the bell should be suspended from a ball-and-socket joint, to allow it to yield and gradually absorb the force of the blow, but the plan was not adopted. My own plan for the same purpose is as follows:—The bell to be suspended so that it can oscillate freely in the plane of the blow, but not in any other, and it will then become a pendulum, swinging in tolerably uniform intervals; then let the time of its oscillation be ascertained, and the interval between the blows of the hammer be so regulated that the bell shall be making one of its return vibrations as the hammer descends to meet it. Each blow would then be made to neutralise the motion caused by the last one, and all accumulating or uncertain motion be prevented; and the advantages would be secured of the bell hanging perfectly free to accommodate itself to the force of the blow, without the recoil-spring having to keep the hammer at a great distance from the bell. The strain on the mountings and frame would also be considerably reduced.

I am, &c.,
E. T. LOSEBY.

4th October, 1859.

Proceedings of Institutions.

Birmingham and Midland Institute.—In the report for last year, the Council announce the first portion of the new building has been completed, and is now occupied for the purposes of the Institute. The Council have endeavoured to render the news-room as attractive as possible. The room intended for a library on the first floor has been comfortably furnished; it is supplied with the principal London and provincial newspapers, and it is believed that it meets with the approval of the members. The larger room, which will eventually be the news-room, is intended to be used as a temporary museum, for which several donations have been received. The interest of the museum will be greatly increased by an arrangement concluded with the Birmingham gun trade. The Committee of Trade are about to make a collection of military and other fire arms, which will form a historical record of the progress of the manufacture, and illustrate recent inventions and improvements. The collection is to be deposited in the Institute Museum, subject to the condition that it shall not be removed, except to some other suitable place of exhibition. The public continue to avail themselves of the "Patent Specification" library. It was consulted by two-hundred and forty persons last year. Thirty-one public lectures and Monday evening readings were given, of which 16 were kindly delivered free of charge, and 5 of these were by members of the Institute. The number of members is now 561—of students qualified by the amount of their fees to avail themselves of the privileges of the general department, 27—total 588, being an increase of 104 since last year. The following is a list of the entries in the various classes, for the three terms:—

Subject.	Winter Term.	Spring Term.	Autumn Term.
*Geometry	6	5	8
*Algebra	9	9	13
*Advanced Arithmetic	21	16	16
Elementary Arithmetic Penny Lessons, Average Attendance	13	18	35
Experimental Physics	14	19	15
Elementary Chemistry	34	30	39
Practical Chemistry	6	5	7
Female Class	6	7	discont.
Junior Class	18	9	13
Penny Lectures, average attendance	238	175	204
*Botany	9	6	discont.
French	141	117	136
*History	20	suspended.	11
*English Literature	36	40	16
*Logic	11	susp.	

* The Classes marked with an asterisk are conducted by honorary teachers.

The female class and the botany class have been discontinued, on account of the small number of pupils, and the Council regret that the illness of the teacher has caused the suspension of the logic class. A class for English Grammar and Composition has been commenced. A new regulation has been established with regard to Certificates and Examinations. Each teacher has been requested to examine his class at the end of the spring term, and Teachers' Certificates are awarded to those students who have made satisfactory progress in the work of the year. Gentlemen appointed by the Council examine the classes at the commencement of the autumn term, and Council Certificates are awarded to those who, after a two years' study, have acquired a satisfactory knowledge of the subject of examination. The Council call the especial attention of the members of the Industrial Department to the Examination of the Society of Arts, an appeal which was well responded to, as is shown by the results of the last Examinations. The Council regret that the financial condition of the Institute is not in such a satisfactory condition as could be desired—the expenditure, both in the general and industrial departments, exceeds the receipts during the past year. This result is in some degree attributable to the occupation of the new buildings, where additional expenses had to be incurred, to supply the conveniences required for the carrying on the operations of the Institute. As these will not occur in subsequent years, it is hoped that, with rigid economy in the ordinary expenditure, the balance in future will appear to the credit of the Institute. The report of the classes for experimental physics, elementary chemistry and practical chemistry, and on the junior class and penny lectures, for last year, show that the average number of students, and the average attendance in the physics, elementary chemistry, practical chemistry, and junior class, and the average attendance at the penny lectures, during the year, have been as follows:—Penny Lectures, average attendance 206; Physics, names entered 16, average attendance 8; Chemistry, names entered 34, average attendance 21; Junior Class, names entered 16, average attendance 17, including members of general department; Practical Chemistry, names entered 6, average attendance 6. In the physics class the subjects treated were, mechanics during the winter and spring terms, and hydrostatics and pneumatics during the autumn term. Those who have attended have studied diligently, and have acquitted themselves very satisfactorily at the Class Examinations. Nearly all the pupils now attending are real students. When the chemistry class commenced in 1854, the greater proportion of those attending it were merely passive listeners to the lectures, and gazers on the experiments, and they dropped away rapidly when the heavier portion of the subject was entered upon. The attendance at the Class Examinations was then very small whenever the examination was announced, and very few took part in these examinations, under any circumstances. In this respect a great improvement has taken place, the course of study has been made more severe, without apparently damaging the attendance, and the pupils have themselves requested that the examinations shall be held more frequently, as they find they learn more from these oral examinations than from the lectures. The teacher proposes, now that he can secure the active co-operation of the students in these examinations, to make them much more frequent than hitherto, to go completely over the whole of the subject matter of the lectures, and to enlarge upon them where the students are found to fail in their answers. He expresses his conviction that the Council Examinations and Certificates, and the Examinations of the Society of Arts, have largely contributed to this improvement. In the practical chemistry class the students are working diligently, and making very good progress. The students who first entered are now able to make qualitative analyses for the acids and bases of complex compounds. Some rather difficult exercises have been given to them, and in almost every case their analyses have been correct. The junior class has fallen off considerably. From the commencement of this class to the present time there have been very few accessions of pupils, so that the places of those who have outgrown the class have not been supplied. The subject of the penny lectures during the winter and spring terms was "The Raw Materials used in the Birmingham Manufactures." The subject during the autumn term has been "Physiology, and the Laws of Health." The interest and attention of the audience, referred to in the last report, has been fully maintained, though the class of people attending has, to a slight extent, altered. The proportion of working men among the audience appears to be rather smaller than formerly. A large proportion, probably two-thirds, attend regularly.

Bristol.—The distribution of prizes and certificates awarded by the Society of Arts to the students examined at the Bristol Athenæum in May last, took place in the lecture-hall of that Institution, on Saturday evening. The chair was taken by the Rev. Canon Girdlestone, President of the Local Board of Examiners, and among the company present were the Revs. C. Evanson, M.A., and J. Burder, M.A.; Messrs. Hazeldine, B.A.; Coen, A.B.; D. Mackie, F.R.S.; I. A. Cooke, treasurer of the Athenæum, and several other members of the Board of Examiners, &c. The chairman addressed the meeting, eulogising the course taken by the Society of Arts in initiating the system of examination which had subsequently been adopted by the Universities, and commenting on the various forms of encouragement for different classes of society now offered to educational efforts. He also noticed the fact that the examination of the Society of Arts afforded the first and only opportunity for ladies to compete for these public rewards of intellectual achievements, and anticipated great good as resulting therefrom. He likewise drew attention to the extraordinary position attained by the Bristol Athenæum examinees in the present year's competition, G. Hale (a pupil of the Bristol Grammar School) having carried off the largest number of prizes (all of the first-class) awarded to any one student, while the only four ladies who have succeeded in winning certificates throughout the kingdom were pupils of the Athenæum, and were now present. On the last occasion four out of the only five successful candidates were also Athenæum pupils. To the whole number of 766 papers worked, only 16 first-class prizes were awarded, and of these six (3-8ths) were awarded to the Athenæum examinees, the proportion of first-class prizes to papers worked being in Bristol upwards of 20 per cent., and in all the other places only 1⅓rd per cent., the proportion being as 15 to 1. The proportion of first-class certificates obtained was also in Bristol three times as great as in the rest of the kingdom. The following prizes and certificates were then handed to the several candidates present, who were hailed with enthusiastic acclamations as they, one after the other, ascended the dais to receive from the hands of the chairman their honourable distinctions:—

Algebra.—1st prize and 1st class certificate, George Hale. Certificates, H. S. V. De Candole, C. P. Evanson, R. C. F. A. Thomas, and D. C. Tovey.
Trigonometry.—1st prize and 1st class certificate, G. Hale. Certificate, E. Clift.
Conic Sections.—1st prize and 1st class certificate, Geo. Hale.
Statics, &c.—1st prize and 1st class certificate, George Hale.
English Literature.—1st prize and 1st class certificate, H. S. V. De Candole; 2nd prize and 1st class certificate, D. C. Tovey.
Latin and Roman History.—1st prize and 1st class certificate, D. C. Tovey. Certificates, H. S. V. De Candole, C. P. Evanson.
Arithmetic.—Certificates, D. C. Tovey, R. C. F. A. Thomas.
Geometry and Mensuration.—Certificate, E. Clift.
English History.—Certificate, H. S. V. De Candole.
French.—Certificates, Miss M. S. Lovell, Miss H. Nash, Miss M. M. Ratcliffe, M. H. Hale, and W. W. Hale.
German.—Certificate, Miss C. E. Shapland.
Music.—Certificate, C. P. Evanson.

M. H. J. V. De Candole, on behalf of his son, moved a vote of thanks to the examiners, which was seconded by Mr. Gardner. The Rev. J. Burder moved a vote of thanks to the directors of the Athenæum, for the liberal manner in which they had placed that institution at the disposal of the Examiners for the purposes of the Society of Arts examination, which was seconded by Mr. D. Mackie, and acknowledged by Mr. I. A. Cooke, the treasurer of the Athenæum. The chairman acknowledged the vote of thanks to the examiners, and the meeting was concluded by Mr. Cooke moving a special tribute to the chairman personally, for his services that evening.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, September 30th*, 1859.]

Dated 20th June, 1859.

1478. L. D. Dewey, 4, Southampton-buildings, Chancery-lane—Imp. in spring seats for chairs, sofas, couches, carriages, and other similar articles. (A com.)

Dated 4th July, 1859.

1589. H. C. Howells, 120, Duane-street, New York, and J. C. Howells, Madison, U.S.—Imp. in the mode of registering the number of persons entering or leaving public conveyances or places of public resort, and of determining the value of the entry or fare.

Dated 27th August, 1859.

1957. J. Philp, Camden-town, Middlesex—Imp. in the manufacture of soap. (A com.)

Dated 29th August, 1859.

1959. J. Whitworth, Manchester—Imp. in ordnance, fire-arms, and ammunition.
1964. J. Edwards, 77, Aldermanbury, London—Imp. in the manufacture of buttons.

Dated 31st August, 1859.

1989. R. A. Brooman, 166, Fleet-street—Imp. in treating auriferous and argentiferous ores and substances.

Dated 3rd September, 1859.

2014. W. Suffield, Birmingham—Imp. in the manufacture of artificial teeth, and in machinery to be employed in the said manufacture.

2016. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in printing' and in apparatus connected therewith. (A com.)
Dated 7th September, 1859.
2038. E. R. Dann and E. Goldschmidt, Nottingham—Imp. in the manufacture of bonnet fronts or lappets.
2040. H. Jones, Birmingham—Imp. in breech-loading fire-arms.
2042. J. L. Jullion and G. Pirie, Aberdeen—The manufacture of gelatine, and apparatus to be employed therein.
2044. A. V. Newton, 66, Chancery-lane—An improved manufacture of metallic strips, or bands applicable to ladies' skirts. (A com.)
2048. W. Rothwell, Carr House, Midgley, Halifax, and T. Watson, Midgley—Imp. in screw gill-boxes.
Dated 8th September, 1859.
2050. T. O. Small, Newcastle upon-Tyne—Imp. in the stereoscope, by means of tinted media, and by the application of the pulley and lever, or spring, in changing the lights.
2052. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in cocks and valves. (A com.)
2054. J. Tandy, Cavendish-grove, Wandsworth-road, Surrey—Imp. in locomotive and other steam boilers.
2056. G. Gowland, Liverpool—Imp. in nautical and surveying instruments for measuring angles.
Dated 9th September, 1859.
2060. S. Worssam, Chelsea—Imp. in sawing machinery.
2062. W. E. Gedge, 4, Wellington-street South, Strand—Imp. in the manufacture of nails. (A com.)
2064. A. V. Newton, 66, Chancery-lane—Imp. in the process of, and machinery for, manufacturing hat bodies. (A com.)
Daeed 10th September, 1859.
2066. A. Smith, Mauchline, Ayr, N.B.—Imp. in strengthening umbrella and walking stick handles, and other articles or details wherein the cross or transverse grain of the wood or other material is subject to strains.
2068. W. Ross, Glasgow—Improved apparatus connected with the discharge of liquids.
2069. E. J. Mallett, New York—Imp. in axles.
2070. T. J. Perry, Bilston, Staffordshire—An improved construction of hot air oven.
Dated 12th September, 1859.
2076. J. Eason, Oxford-street—Imp. in the manufacture of buff or losh and other oiled leathers.
2078. W. H. Morrison, Nottingham—Imp. in the manufacture of bonnet and cap fronts, and in the means or apparatus employed therein.
2080. J. Mason, Birmingham—An imp. in boxes or cases and cards to contain or hold pens.
2082. W. Elliott, Birmingham—Imp. in the manufacture of African or Guinea rods.
Dated 14th September, 1859.
2091. C. G. Gumpel, 2, Gordon-cottages, Holland-road, Brixton, Surrey—Imp. in the application of motive power to the propelling of vessels.
2093. Lieut.-Col. J. P. Kennedy, Torrington-square, Middlesex—Imp. in steam boilers.
2095. C. Beslay, Rue St. Sebastian, Paris—Imp. in preparing and obtaining printing surfaces with designs sunk as also in relief.
2097. J. S. Slocum, Providence, Rhode Island, U.S.—Imp. in projectiles, suitable for ordnance. (A com.)
Dated 15th September, 1852.
2099. J. Robinson, Sutton, near Hull—An improved agricultural implement.
2101. J. Brière, Brussels—Imp. in railway breaks.
2103. H. Winter, Albion-terrace, Hackney, Middlesex—A machine or apparatus for lifting and weighing loaded sacks, and also merchandize.
Dated 16th September, 1859.
2105. J. W. Hadwen, Kebroyd Mills, Halifax—An imp. or imps. in apparatus or machinery used for drawing fibrous substances or materials in any of the processes or machines for preparing to be spun, or for spinning the same.
2107. N. Heckford, Forest Gate, Essex—A method of purifying the Thames and other rivers, and of treating night soil.
2109. W. E. Newton, 56, Chancery-lane—Imp. in machinery for forming hat bodies. (A com.)
2111. H. Jackson, Oak-lane, Limehouse—Imp. in fire bars.
Dated 17th September, 1859.
2113. J. Luis, 1B, Welbeck-street, Cavendish-square—A new brick and tile making machine. (A com.)
2115. J. Luis, 1B, Welbeck-street, Cavendish-square—Further imp. in brakes for railway carriages. (A com.)
2117. J. Luis, 1B, Welbeck street, Cavendish-square—A slip bridle for stopping runaway horses. (A com.)
2119. J. Luis, 1B, Welbeck-street, Cavendish-square—An improved disc and lantern signal with double repeaters. (A com.)
2121. S. N. Rodier, Prospect-cottage, Stand-on-the-Green, Chiswick, Middlesex—Imp. in the regulation of gas to burners, which he calls "Rodier's regulating gas valve."
2123. A. J. Norman, Gore-lodge, Turnham Green, Chiswick, Middlesex—Paving roads and surfaces.
Dated 19th September, 1859.
2125. F. N. Gisborne, 3, Adelaide-place, London Bridge—Paying out submarine telegraphic cables.
2127. W. Robertson and J. Tweeddale, Johnstone, Renfrew, N.B.—Imp. in hydrostatic jacks, or lifting apparatus. (A com.)
2129. J. Wright, 42, Bridge-street, Blackfriars—Imp. in the construction of carriages, coaches, omnibuses, and other such like conveyances. (A com.)
2131. P. Fairbairn, Leeds—Improved machinery for finishing the teeth of spur and other gearing.
2133. R. A. Brooman, 166, Fleet-street—Imp. in elevators or lifts, for hotels, warehouses, and other structures. (A com.)
2135. L. Engler and E. F. Krauss, 29, Boulevart St. Martin, Paris—A new or improved system of insulators for electric wires.
Dated 20th September, 1859.
2139. W. Weild, Manchester—Imp. in fluted rollers, used in machines for preparing, spinning, and doubling cotton, wool, flax, silk, and other fibrous materials, and in the manufacture of such rollers.
2141. J. Beads, Pendleton, near Manchester—Imp. in machinery or apparatus for spinning cotton, wool, or other fibrous substances, part of which improvements is applicable to other purposes.
2143. W. E. Newton, 66, Chancery-lane—Imp. in projectiles. (A com.)
2145. E. Collier, Myddelton-street, Clerkenwell—Imp. in ear dilators.
Datcd 21st September, 1859.
2147. H. Corless, West Derby, Lancashire—Imp. in apparatus for washing, wringing, and mangling.
2151. W. E. Newton, 66, Chancery-lane—An improved mode of and apparatus for condensing the waste steam of marine engines.—(A com.)

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, Septenber 30th*, 1859.]

September 29th.
797. J. Cartwright.
798. Capt. C. P. Coles, R.N.
801. W. Smith and E. Smith.
807. A. Morton.
813. D. K. Clark.
814. F. P. A. Auburtin.
822. Y. M. Thomas.
824. A. Ripley and J. Roberts.
832. M. Coupland.
834. T. Williams and J. H. Fuller.
836. J. Eccles.
840. J. H. Burton.
843. C. Russell.
844. M. A. Crooker.
846. E. Morewood.
848. A. Shanks.
850. E. Fairburn.
852. F. C. Bakewell.
853. G. F. Chantrell.
855. J. Hetherington, T. Webb, and J. Craig.
861. J. A. H. Ballande.
862. W. Owen.
864. J. Scoffern.
865. D. Moseley.
871. J. Garrett.
873. J. T. Pitman.
878. M. A. F. Mennons.
880. N. A. Grumel.
883. W. Henderson.
885. E. R. Handcock.
886. T. Spencer.
891. J. H. Johnson.
895. W. E. Newton.
934. J. Gillett.
957. W. E. Newton.
960. H. Harrison.
982. W. Parsons.
987. I. Dutton, R. Martin, and T. Phillips.
991. A. V. Newton.
1046. R. Main.
1051. J. H. Johnson.
1090. C. H. G. Williams.
1109. W. Sellers.
1134. W. E. Newton.
1135. W. E. Newton.
1295. A. V. Newton.
1418. H. J. Nicoll.
1529. J. Boden and W. Clark.
1538. G. Dawes and C. J. Carr.
1580. T. J. Hart.
1587. J. Hollingworth.
1627. D. Mathews.
1639. C. Iliffe.
1658. A. Cooper.
1720. S. A. Bell and J. Black.
1738. J. Gillott and J. Morrison.

[*From Gazette, October 4th*, 1859.]
October 1st.
863. J. Rogers and E. J. Tweed.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, September 30th*, 1859.]

September 26th.
2267. F. Ransome.
2293. J. Dauglish.
September 27th.
2279. R. Morrison.
2443. L. J. P. de Mirimonde.

[*From Gazette, October 4th*, 1859.]

September 29th.
2334. H. Mackworth.
September 30th.
2413. G. Hazeldine.
October 1st.
2305. E. Hardon and J. Henry.
2319. G. F. Wilson and A. I. Austen.
2320. D. O. Boyd.
2325. A. Dunlop.
2348. G. F. Wilson.
2349. W. Marriott and D. Sugden.
2378. F. A. Gatty.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, September 30th*, 1859.]

September 27th.
56. J. Finlay.
77. S. Soulby.
96. H. Bridson.
103. C. Lungley.
142. H. B. Barlow.
September 28th.
6. M. Poole.
16. M. Poole.
19. M. Poole.
24. M. Poole.
28. M. Poole.

[*From Gazette, October 4th*, 1859.]

September 29th.
30. M. Poole.
33. M. Poole.
37. M. Poole.
43. M. Poole.
123. R. Whytock.
September 30th.
9. G. Green.
57. J. J. Macdonnell.
156. J. Brown.
160. J. Burch.
163. M. Poole.
172. J. Jobson.
237. H. Jager.
246. G. H. Cottam.
251. A. E. L. Bellford.
October 1st.
41. J. Barrans.
184. J. Needham.
187. A. Miller.
214. T. Kennedy.
272. J. Hill.
275. A. R. le Mire de Normandy.

Journal of the Society of Arts.

FRIDAY, OCTOBER 14, 1859.

ON THE ACTION OF HARD[*] WATERS UPON LEAD.

By W. Lauder Lindsay, M.D., F.L.S.[†]

It is, and has long been, currently believed—1. That where there is free access of atmospheric air, pure or soft waters—that is, waters absolutely or comparatively free from saline ingredients, readily corrode lead and become impregnated—sometimes to a poisonous degree—with some of the salts thereof. 2. That the rapidity and extent of this solvent or corrosive action are proportionate to the purity of the water—that is, its freedom from neutral salts. 3. That impure or hard waters, that is waters containing a considerable amount of neutral salts, do not so affect, or become impregnated with, lead. 4. That such waters are prevented from acting on lead by, or in virtue of, their saline constituents, which exert a sort of protective or preservative power in regard to the lead. 5. That, if a given water does not, within a short period, cause a white coating on freshly burnished lead plates or rods, it may be regarded as destitute of any corrosive action, and may therefore be safely allowed to be kept in cisterns, and transmitted through leaden pipes.

Observation, experiment, and inquiry have led me to the following somewhat opposite conclusions:—1. That certain pure or soft waters *do not* act upon lead. 2. That certain impure or hard waters, in some cases containing abundance of the very salts which are generally regarded as most protective or preservative, *do act* upon lead. 3. That the rationale of the action in these anomalous or exceptional cases is very imperfectly understood. 4. That experimentation on the small scale, and for short periods, is most fallacious, and frequently dangerous, in regard to the conclusions thence to be drawn. 5. That water may, under certain circumstances and to certain extents, contain lead without necessarily being possessed of appreciable poisonous action on the human system. 6. That water contaminated with lead may deleteriously affect certain members or individuals only of a community, family, or household. 7. That the use of water so contaminated is the obscure cause of many anomalous colicky and paralytic affections.

The remarks which follow are intended to be purely suggestive; they are meant chiefly to introduce to the notice of the chemical section of the British Association the fact that the rationale of the non-action of certain soft waters, and of the action of certain hard waters, on lead is very imperfectly understood. The subject of the action of waters upon lead is not at all in a satisfactory state; and in these days of sanitary legislation, when we are boasting of our acquirements in sanitary science, this is an *opprobrium scientiæ* and an *opprobrium medicinæ* which should no longer be permitted to exist. Chemists are totally at variance; when they agree they chiefly agree in what I believe to be error; their analyses are most contradictory, and their theories still more so. In order to place this fact prominently before the reader, I need make but a few citations.

"Numerous attempts," says Dr. Medlock, "have been made by some of the most able chemists to arrive at a correct solution of this important question; but it will be admitted that all their attempts have hitherto failed, and that the conclusions arrived at are unsatisfactory in the extreme. Dr. Noad examined three waters, which were known to act strongly upon lead. The first was taken from a deep well in the neighbourhood of Highgate churchyard, and was found to contain 100 grains of solid matter in a gallon, of which 57 grains consisted of the nitrates of lime and magnesia. The second water, from a spring at Clapham, contained 77·74 grains of solid matter in a gallon, consisting of salts of lime, magnesia, potash, and soda, with 4·10 grains of organic matter. The third water, which was found to act upon lead, was that from the deep wells of London. This water contains about 68 grains of solid matter in a gallon, consisting chiefly of the salts of potash and soda, with very little carbonate of lime or organic matter. These waters differ widely in their chemical composition. In the first nitrates prevail, in the second organic matter, and in the third alkaline carbonates. The action of the first on lead he attributes to nitrates; that of the second to organic matter; and that of the third to free alkali! Dr. Smith, who investigated the action of the waters of the Dee and Don on lead, found that the quantity of lead dissolved increased with the time the water remained in contact with the metal. He considers the action of these waters on lead to be due to the quantity of air dissolved in them."[*]

It may admit of a doubt whether the opinion of Dr. Lambe, of Warwick, that all natural waters must be held to act upon lead,[†] which therefore is at all times, and in all circumstances, a dangerous metal to have in contact with drinking water, is not safer, so far as the public health is concerned, than the more modern idea, that a small quantity of certain neutral salts in water acts invariably as a preventive to its action on lead. I have no desire to create unnecessary alarm; but I have a desire that chemistry should be more creditably represented in its relation to sanitary science than it at present is in reference to the action of drinking waters on lead.

In regard to the desirableness of a thorough knowledge of the chemistry of the phenomena in question, I need here say nothing. The action of drinking and culinary waters on lead is a subject of too great moment to the national health to be lightly considered. Few of our standard writers on Chemistry, Materia Medica, or Public Hygiene, omit reference to this subject. But unfortunately many errors may have crept into their works; and these errors have been the means of disseminating false views, not only among the public, but also among the medical profession. Statements of the most opposite kinds will be found in our most familiar text-books on Chemistry and Materia Medica; and this is the more curious and extraordinary, inasmuch as they all profess to borrow or quote from the admirable researches entered upon and published by Professor Christison, of

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[*] I use the term *hard waters* to indicate waters containing an easily appreciable amount of neutral salts, especially of the carbonates, sulphates, and chlorides of lime and magnesia. Under this head a large proportion of spring waters is to be classed. The term is employed in contradistinction of *pure* or *soft* waters, which either contain no saline ingredients, or a very small proportion: such are rain, snow, and many river waters. I think it necessary thus to define my meaning, because I have found that there is frequently great difference of opinion between professional and non-professional persons as to what is, or constitutes, hard or soft water. A water, in reference to which I will immediately have occasion to make some statements, was reported upon by the analyst, an English chemist of repute, as "very soft," while the user of the water, a lady of great intelligence and experience, described it to me as decidedly hard. Professor Christison considers a water soft which contains less than $\frac{1}{5000}$ part of its weight of saline ingredients; hard if it contains more than $\frac{1}{4000}$; mineral if more than $\frac{1}{2000}$. Soft water has the property of forming a lather with soap, and it is suitable for washing purposes, neither of which properties does hard water possess.

[†] Read before the Chemical section of the British Association, Leeds Meeting, 24th September, 1858.

[*] "On the Action of certain Waters upon Lead;" Record of Pharmacy and Therapeutics of General Apothecaries' Company, London. Part 2, p. 33. 1857.

[†] Dr. Lambe, of Warwick: Researches into the Properties of Spring Waters, 1803, quoted in Dr. Christison's Treatise on Poisons, 1835.

Edinburgh, now many years ago. It is true that this gentleman lays down, as a general rule, that pure waters corrode, and become contaminated with, lead; a certain proportion of some saline matters, however, exercising a protective influence, and preventing such contamination. But, as I read and understand the narrative of his experiments and the statements of his conclusions, he appears to me to admit fully and freely that there are exceptional cases of the nature mentioned in my propositions.[*] These exceptional cases are not brought so prominently under notice in his various publications on the subject as they deserve to be, nor are they in general satisfactorily explained. But I think that Professor Christison has been very unfairly quoted, nay, frequently mis-quoted, by compilers, who have never taken the trouble to investigate the matter for themselves. In some text-books the statements made are absolutely erroneous; in others they are too dogmatic and positive,—general rules only being laid down, and exceptions, which are of the utmost importance, being omitted. In order to illustrate the errors of omission or commission to which I have just adverted, I will cite a very few quotations from well-known works on chemistry or materia medica. Professor Graham says[†]—"Rain or soft water cannot be preserved with safety in lead cisterns, owing to the rapid formation of a white hydrated oxide at the line where the metal is exposed to both air and water: the oxide formed is soluble in pure water, and highly poisonous. But a small quantity of carbonic acid, which spring and well water usually contain, arrests the corrosion of the lead by converting the oxide of lead into an insoluble salt, and prevents the contamination of the water." Dr. Graham professes to quote from the conclusions of Professor Christison: but the above two sentences contain several statements at variance with the results arrived at by the latter gentleman, and by the majority of experimenters on this subject. The crust or film produced by the action of pure water on lead is neither a simple hydrated oxide nor a simple carbonate, but a permanent compound or mixture of both,—in the proportion, according to Professor Christison, of two equivalents of the latter to one of the former. Where the water contains saline matters, in the deposit are generally found, in addition, the sulphates and chlorides and other salts of lead. Carbonic acid in the water, so far from preventing contamination, assists it, according to Professor Daniell and others, by dissolving a portion of the precipitated carbonate of lead. The carbonic acid, which is the source of the metamorphosis of the hydrated oxide of lead into carbonate, is generally derivable from the atmosphere, not from the water, and this agent operates more powerfully in pure than in hard water. Professor Fyfe, of Aberdeen, in a somewhat extraordinary paragraph,[*] remarks—"Water, when pure, has no action with lead; but if it be admitted, the metal is slowly oxidated and dissolved. The action goes on more quickly when spring water is employed, the presence of the minute quantity of saline matter in it favouring the action. Hence the corrosion of leaden cisterns and pipes conveying water!" It is needless here to point out how completely at variance with the truth these statements are. So entirely are matters reversed, that it would almost appear as if there were some typographical error! Again, Sir Robert Kane[†] says—"No danger is, therefore, to be apprehended from the supply of water to a city being conveyed through leaden pipes and preserved in leaden cisterns; for all water of mineral origin dissolves, in filtering through the layers of rocks in its passage to the surface, a sufficiency of saline matter to serve for its protection." Other authors follow Professor Christison more closely and correctly, and make use of more cautious expressions. But here, again, I must prefer the complaint that the exceptional cases, to which I have already referred, are mentioned in so subordinate a way and place that they are apt to be entirely overlooked by the casual reader. Hence the propagation of errors.

In reference to my first proposition, that certain comparatively pure, or what are usually considered soft, waters, do not act on lead, it may be mentioned that Professor Christison[‡] found rain water collected on his own house in Edinburgh to be devoid of any corrosive action—a circumstance which he attributes to the presence of alkaline sulphates and chlorides. Again, Professors Graham, Hoffmann, and Miller, who some time ago conducted a Government investigation into the action of waters on lead, with a view to discover "whether any comparative inconvenience would arise from a supply of soft water to the metropolis," contrary to what might have been expected, assert that, "with one exception, neither the soft waters of the Surrey Hills, which have a hardness of only two degrees, nor spring water artificially softened to three degrees of hardness, have any perceptible action on lead. The idea that soft waters invariably act upon lead seems to have its origin in the fact that certain specimens of distilled water, placed in contact with a large surface of bright sheet lead, dissolve as much as six or eight grains of the metal to the gallon."[§] Dr. Medlock[||] asserts that "perfectly neutral and pure" distilled water, from which nitrate of ammonia has been expelled, has no action upon lead; for, in a gallon of this water, allowed to remain in contact with 560 square inches of lead for forty-eight hours, no trace of lead could be discovered.

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[*] I append a few quotations or statements from Professor Christison's publications on the subject:—"The action is impeded by the co-existence of any neutral salts in the water; and some salts, whose acids form very insoluble compounds with oxide of lead, prevent the action entirely in very minute quantity."[*] "Water, which contains less than about $\frac{1}{8000}$ of salts in solution cannot be safely conducted in lead pipes without certain precautions. Even this proportion will prove insufficient to prevent corrosion, unless a considerable part of the saline matter consist of carbonates and sulphates, especially the former. So large a proportion as $\frac{1}{4000}$, probably even a considerably larger proportion, will be insufficient if the salts in solution be in a great measure muriates. It is, I conceive, right to add that in all cases, even though the composition of the water seems to bring it within the conditions of safety now stated, an attentive examination should be made of the water after it has been running for a few days through the pipes. For it is not improbable that other circumstances besides those hitherto ascertained may regulate the preventive influence of the neutral salts."[†] "When lead has been exposed for a few weeks to a solution of a protecting salt, and has acquired a thin film over its surface, it not only is not acted on by the solution, but is even also rendered incapable of being acted on by distilled water."[‡] "Most spring waters, unlike rain or snow water, have little or no action on lead, because they generally contain a considerable proportion of muriates [?] and sulphates."[§] "The general result of these experiments appears to be that neutral salts, in various, and for the most part minute, proportions, retard or prevent the corrosive action of water on lead, allowing the carbonate to deposit itself slowly, and to adhere with such firmness to the lead as not to be afterwards removable by moderate agitation, adding subsequently to this crust other insoluble salts of lead, the acids of which are derived from the neutral salts in solution; and thus, at length, forming a permanent and impermeable screen, through which the action of the water cannot any longer be carried on."[||]

[†] Elements of Chemistry, vol. ii., p. 111. London, 1858.

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[*] Dispensary, second edition. 1848. Art. *Plumbum.*

[†] Trans. Royal Society of Edinburgh, vol. xv., part 2, p. 271.

[‡] Treatise on Poisons, 1835, p. 481.

[§] Ibid., p. 486.

[||] Ibid., p. 483.

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[*] Elements of Chemistry. Second ed., p. 529. Edinburgh, 1830.

[†] Elements of Chemistry. Second ed., p. 558. Dublin, 1849.

[‡] Treatise on Poisons, 1835, p. 484, "On the Action of Natural Waters on Lead."

[§] "On the Action of certain Waters upon Lead," by Dr. Medlock; Record of Pharmacy and Therapeutics, Part II., p. 34; General Apothecaries' Company. London, 1857.

[||] Ibid., p. 35.

My second proposition I can illustrate more easily and fully. The illustrations which have presented themselves to my notice have been chiefly of the two following kinds:—1. Corrosion, or erosion, to such an extent as to cause leakage, of cisterns by waters of various degrees and kinds of hardness, or containing various kinds and amounts of neutral salts. 2. The poisonous action of hard or hardish waters impregnated with lead on the human body.

It is needless to multiply instances; two or three must here suffice; but they will probably serve to recall to the memory of many of my readers parallel illustrations. My attention was specially called to the erosion of lead cisterns by spring or well waters about two years ago, by my being requested to examine some cisterns, the bottom lining of which had been repeatedly eroded to the extent of causing leakage, and which had been as repeatedly repaired. These cisterns contained the water supply of a large public institution of which I am the physician. The institution is supplied with water from three different sources, viz.—1. Rain water from the roof; 2. Spring water; and 3. Surface water. With the first I have here nothing to do; it is in reference to the second especially, and also subordinately to the third, that my remarks apply. The spring water is from a deep well on the northern declivity of Kinnoull Hill, penetrating the Old Red Sandstone near where the trap protrudes through it. The water rises in the well to the height of twenty-eight feet. It is good, hard, drinking water, and is used in the institution for drinking, as well as for culinary purposes. The surface water is chiefly rain water, which percolates through the soil, and is collected in a large tank holding 95,156 gallons. This water is used chiefly for baths, water-closets, and general cleansing processes. The cisterns have no covers; they are contained in the attics of the buildings, but are not exposed directly to the external air. My attention was first directed to the cistern containing the spring water. I found the leaden bottom of this cistern scooped out here and there into a series of cavities or holes, some of which were minute perforations, allowing of an escape of the water. Moreover, the bottom was covered by a pretty thick layer or coating of a heavy cream-yellow, putty-like matter, which also filled the cavities or holes above referred to. The cistern was comparatively new. I was told it had been repeatedly thus eroded, and as frequently repaired. But it would appear that the mode of repair had been mere soldering; and this, it is of great importance to bear in mind, inasmuch as I believe this mode of repair to have been the cause of the subsequent more rapid erosion. It has now been abundantly proved that galvanic action occurs in a leaden cistern holding water at the point of contact of the lead with other metals, whether these be in the form of solder or of iron bars, &c.; that this galvanic action is extremely favourable to corrosion; and that it is greatest in waters containing saline matters,—that is, precisely in circumstances in which, were there no galvanic action, the corrosive effect of the water would be least. Similar phenomena had been repeatedly observed in cisterns containing the surface water; and the leakage of these cisterns became a matter of some moment, not only from the expense of constant repairs in comparatively new cisterns, but also from the damage done to the roofs and walls of apartments situated below the attics by the escaped water. Facts bear out what theory would lead us to conclude, that the newer the cistern the more rapid and energetic is the corrosive action of the water on it.

I was naturally led to make an analysis (a rough and qualitative one only, however), with a view to discover precisely the circumstances under which this corrosive action took place. This analysis embraced,—1. The deposit on the bottom of the cistern; 2. The supernatant water in the cistern; and, 3. The spring water, as drawn from the well before it had traversed iron pipes, or been contained in leaden cisterns. The results were as follow:—The deposit contained carbonates, sulphates, and chlorides of lead, lime, and magnesia; iron in abundance; and faint traces of soda. The supernatant water contained the sulphates, carbonates, and chlorides of lime and magnesia, with traces of soda. The carbonates and chlorides were most abundant—the sulphates less so; lime was plentiful; magnesia was in small quantity. There was no lead; and this is of importance to bear in mind; for it frequently happens that, though lead is found abundantly in the deposit on the bottom of such a cistern, it cannot be detected readily, or at all, in the supernatant fluid. Nor did this water contain distinct traces of iron. The spring water, as drawn directly from the well, contained the same salts of lime, magnesia, and soda, in similar proportion, without lead or iron. The iron found in the cistern deposit was probably dissolved as oxide by the water as it passed through the iron pipes which convey it from the well to the institution; but it may also partly have been derived from the soil. A more careful analysis would probably, however, have detected it in the water of the cistern, and possibly in the water drawn directly from the well, being, in the latter case, derived from the iron apparatus of the pump. Distrustful of my own analysis, I had it repeated more carefully by a friend in Edinburgh.* His results were entirely corroborative of my own more rough and hasty essays. The lead in the deposit was by him converted into sulphate, with a view to ascertain its quantity. Calculating from the weight of the sulphate thus obtained, the deposit was found to contain no less than 43·18 per cent. of lead,—a large amount, to account for which it is right to mention that, in scraping the deposit from the bottom of the cistern, minute portions of metallic lead had been probably included.

Now, the water in question curdles soap with great rapidity and ease, and is therefore decidedly hard. But, in considering the action of water on lead, it is important to remark the nature or kind, as well as the amount, of the neutral salts present in it. The carbonates and chlorides were much more abundant than the sulphates, while lime was plentiful, and magnesia and soda occurred only in small quantity. The water of Airthrey Well, Bridge of Allan, for instance, is said to possess no action on lead; yet it contains no less than $\frac{1}{77}$th part of its weight of salts, which are chiefly sulphates and chlorides.† The experiments of Professors Christison and Taylor, and others, have established that the sulphates and carbonates are among the most protective or preservative salts, while the chlorides are among the least so. There is a difference of opinion among observers as to whether the carbonates or sulphates of lime and magnesia are most strongly protective; but there is no doubt that the sulphate of lime is a powerfully protective salt, while it is also one of the most common ingredients of hard waters. According to Professor Taylor, sulphate of lime is the salt occurring in hard waters, which chiefly prevents their corrosive action on lead; and he describes the coating deposited on the lead as consisting of the sulphate of lead. The results of Professor Christison, as well as a consideration of the chemical theory of the action, would lead to the suspicion that the latter statement is not quite accurate; for it is extremely probable, that not only sulphate, but also the carbonate and hydrated oxide of lead, will at least be found in such deposits. Professor Taylor deduces from his investigations, that a water containing sulphates and lime is not likely to corrode, or become contaminated with, lead, and may therefore be safely used for drinking and cooking.

I made a series of comparative analyses, with a view to ascertain especially the condition as to hardness, or the nature and amount of the saline constituents, as well as the action upon lead, of various waters used for drinking and culinary purposes in and around Perth. The following are briefly the results at which I have arrived,

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* Made in June, 1857.

† Christison on Poisons. 1835. P. 486.

—the analyses or experiments in question being only tentative or qualitative,—rough and approximate in character, and not aiming at quantitative accuracy :—

I. Well Waters; decidedly Hard.—The wells, the waters of which were examined, are apparently chiefly sunk in the Old Red Sandstone, near where it is penetrated by the trap mass of Kinnoull Hill.

1. Rosemount, Bridgend, Perth; well 16 feet deep.—*a.* Water drawn from lead pipes in the house, but before entering cisterns; carbonates, sulphates, and chlorides abundant; lime and magnesia also abundant, especially the former; sediment or solid matter, on evaporating to dryness, comparatively large; no lead nor iron.—*b.* Water drawn from cisterns lined with lead, but covered with wood, placed in garrets, and not exposed directly to external air. Had precisely the characters of that described under head *a.*

2. Murray's Royal Institution, Kinnoull Hill, Perth. —West well, at a considerably higher level than the well at Rosemount. Water, after passing through lead or iron pipes, taken from a lead cistern in the Institution, having no cover; sulphates and chlorides abundant, particularly the former; lime abundant; magnesia in small quantity; neither lead nor iron; burnished lead rods immersed in the water which was exposed to the air became tarnished or streaked white with carbonate in four or five days, but the water was not rendered opalescent nor muddy till the end of one month's immersion.

3. Pitcullen House, Bridgend, Perth.—The elevation of the well is intermediate between that of the wells at Rosemount and Murray's Royal Institution; all three being situated on the slope of Kinnoull Hill. The water had precisely the characters of that of the other two wells above described. Burnished lead rods were tarnished in five days, but were not further affected at the end of one month's immersion, at which time, also, the water in which they were immersed was unaffected as to its transparency.

II. Spring Waters; mostly Hard.—The springs referred to appear to rise from the trap of Kinnoull Hill (consisting of basalts, amygdaloids, and tufas, chiefly), at or near where it bursts through the old red sandstone of lower Perthshire. Like the wells above described, these springs are all situated on the declivity of Kinnoull Hill.

1. Bowerswell, Bridgend, Perth.—Carbonates, chlorides, and sulphates abundant, particularly the two former; lime abundant; magnesia in small quantity; sediment or solid matter, on evaporating to dryness, considerable; burnished lead rods tarnished after three days' immersion; no change of transparency of water after one month's immersion.

2. Muirhall Quarry, Kinnoull Hill.—This is an old basalt quarry, at a higher elevation on Kinnoull Hill than any of the springs, wells, or other sources of water supply, which I have described, or am about to describe. There is a perennial spring at the bottom of the quarry, now covered by a mass of water which has accumulated for years. But this mass of water consists, in great measure, of rain water and of surface drainage water from the neighbouring fields. It is a very soft, comparatively pure water. Carbonates plentiful; chlorides and sulphates in small quantity; lime and magnesia also in small quantity; considerable sediment on evaporation; burnished lead rods tarnished by five days' immersion; but transparency of water unaffected at the end of a month.

3. Bridgend Water Company's supply.—Water taken from the stream immediately before it enters the reservoir at New Scone. The water in question flows from, and constitutes the overflow of, the water in the quarry immediately before mentioned. The composition of the water was identical with that of the quarry water, except that there was a small sediment on evaporation. Its action on lead was also precisely similar.

III. Surface or Drainage Water; Hard.—This is chiefly rain water, percolating through the soil; but it is also partly made up of spring water of the characters already described.

1. Murray's Royal Institution, east tank.—Carbonates, sulphates, and chlorides in considerable quantity, especially latter; lime and magnesia also in notable amount, especially former; sediment, on evaporation, considerable; lead began to be slightly tarnished after one night's immersion; but the water remained clear after one month.

IV. River Water; decidedly Soft.

1. Tay River water, taken directly from the river as it flows past Perth. This is the source of supply of the Perth Water Company. It is comparatively pure; and in this respect resembles the water of Muirhall Quarry and the Bridgend Water Compamy. Carbonates, chlorides, and sulphates, in small quantity, especially latter; considerable sediment, chiefly mechanical impurity, on evaporation; lead began to be tarnished after a single night's immersion; it was quite tarnished in four days, but the water was unaffected in its transparency after one month's immersion.

2. Tay River water, drawn from the cistern of the water works, South Inch, after filtration. Water had precisely the characters described under the head IV., No. 1.

V. Rain Waters; very Soft.

1. Pitcullen House; rain water barrel.—No carbonates; almost no chlorides; a trace of lime and sulphates; sediment, on evaporating down, very small, and chiefly mechanical impurity; lead tarnished, and water, in which it was immersed, opalescent after one night. After three nights' immersion the water was full of white pearly crystals of carbonate, which rapidly accumulated by longer exposure.

2. Murray's Royal Institution; rain water cisterns.—No appreciable amount of chlorides, carbonates, lime, nor magnesia; faint traces of sulphates; sediment, on evaporating down, very small, and chiefly mechanical impurity; lead tarnished and water opalescent after a single night's immersion. After five days, lead rod copiously covered with flocculent masses of crystals of carbonate, which also formed a plentiful sediment; they formed more rapidly, and in greater abundance, than in the rain water from Pitcullen House.

It will be observed that all the waters examined possessed some action on lead; though only in the cases of the rain waters was this action apparently dangerous in amount or degree.

It has sometimes been ignorantly believed that deposits in lead cisterns, such as I have described, are the precipitated salts of hard waters, which are themselves the means of corroding the metal; and, under this impression, great care has been taken to scrape away the deposit so as to expose a fresh surface of lead. This procedure, of course, has only had the effect of aggravating the mischief! Again, it has been imagined by those who regard such deposit as consisting wholly or partly of carbonate or other insoluble salts of lead, that the supernatant water cannot possibly contain salts of lead, and cannot therefore possess any poisonous properties. Now, even the carbonate, which is undoubtedly insoluble in pure water, may be held in solution, it would appear, in minute quantity—sufficient, however, to possess poisonous properties—if the water is surcharged, as is frequently the case, with carbonic acid. Further, it is not at all necessary that it be held in solution in order to the development of its poisonous properties, for it may be simply held in suspension in a state of very minute division, in which case there is no doubt of its possessing a poisonous action on the human system. Besides, the hydrated oxide, as well as the chlorides and nitrates, which are frequently, if not always, found in such deposits, are all sparingly soluble in water, and may be, individually or severally, the source of poisonous action. It is sufficiently established, that the chlorides of lime and magnesia are common constituents of spring waters; but it is not perhaps so generally known that the nitrate—according to some chemists, the *nitrite*—of ammonia, or other nitrates or nitrites, occur frequently in rain, as well as in river and spring waters. The mere transparency of a water cannot be regarded as a proof that no lead exists in it. It may appear perfectly pure, and yet contain dissolved hydrated oxide, or other salts of lead, which are slowly thrown down as white and insoluble carbonate on exposure to the air.

(*To be continued.*)

BRITISH ASSOCIATION, ABERDEEN, 1859.

MERCANTILE STEAM TRANSPORT ECONOMY.

By Charles Atherton, Chief Engineer, Royal Dockyard, Woolwich.

The following paper was read before the Mechanical Section:—

Public usefulness, as dependent upon science, being the great object for which the "British Association for the Advancement of Science" was originated, and has now been signally upheld for 29 years, a period remarkable for the progress that has been made in the utilisation of the powers of nature, to such an extent that the international condition of the globe is now being revolutionized by the progressive practical utilisation of elements which heretofore were regarded merely as phenomena of nature, viz.:—Steam and Electricity; in which revolution the application of steam to the purposes of navigation has played so conspicuous a part, that now, in proportion as steam may be effectively employed in the pursuits of commerce and of war, it is acknowledged that even nations will rise or fall; seeing, moreover, that at no period in the history of steam navigation has so great a step been made in its practical development as may now be said to have been realized by the fearless introduction, in marine engineering, of the long known and well understood effects of increased pressure, superheating, and expansion; the recognition and application of which principles have now, at length, been attended with such effect in marine engineering, that the consumption of fuel with reference to power is now shown to be practically reducible to less than one-half of the ordinary consumption of coal on board ship. Seeing also that mercantile enterprise, setting no limits to speculative investments, has in these days emancipated mechanical intellect from the fetters by which ideas as respects magnitude have hitherto been bound; under such circumstances I cannot doubt that any effort to popularise a knowledge of the practical utilisation of steam, with reference to the consumption of fuel, though advanced with no pretentions to science, beyond that which may be awarded to originality, and labour in the application of calculation to developing useful results, will be favourably received, more especially as the paper which I now beg to present is in continuation and conclusion of an inquiry which has already, in part, on two occasions, been favourably entertained by this Association, and honoured with a place in its published records. The former papers to which I allude are:—1st. "Mercantile Steam Transport Economy, with reference to Speed."—Vol. for 1856, p. 423.* 2nd. "Mercantile Steam Transport Economy, with reference to the Magnitude of Ships and their Proportions of Build."—Vol. for 1857, p. 112.† And I now propose to bring this inquiry to its conclusion by the following paper on:—

Mercantile Steam Transport Economy, as affected by the Consumption of Coals.

TABLE C.

Calculated for the speed of ten knots per hour, and showing the mutual relation of Displacement, Power, and the consumption of coal per day, hour, and knot, the Co-efficients of Dynamic performance, deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h. p.}}$ being assumed to be 250, and the consumption of fuel at the rate of 2½ lbs. per ind. h. p. per hour.

Displacement.	Nominal H.P. taken at the unit 100,000 lbs. 1ft. per min.	Indicated H.P. taken at the unit 33,000 lbs. 1ft. per min.	Coals.		
			Per Day of 24 hours.	Per Hour.	Per Knot.
Tons.	H.P.	Ind H.P.	Tons.	Cwt.	Cwt.
250	52	159	4·26	3·55	·36
300	59	179	4·80	4·00	·40
350	66	199	5·33	4·44	·44
400	72	217	5·81	4·84	·48
450	78	235	6·30	5·25	·53
500	83	252	6·74	5·62	·56
600	94	285	7·63	6·36	·64
700	104	315	8·44	7·03	·70
800	114	345	9·24	7·70	·77
900	123	373	9·98	8·32	·83
1,000	132	400	10·70	8·92	·89
1,100	141	426	11·4	9·51	·95
1,200	149	452	12·1	10·1	1·01
1,300	157	476	12·7	10·6	1·06
1,400	165	501	13·4	11·2	1·12
1,500	173	524	14·0	11·7	1·17
1,600	181	547	14·6	12·2	1·22
1,700	188	570	15·4	12·8	1·28
1,800	195	592	15·8	13·2	1·32
1,900	203	614	16·4	13·7	1·37
2,000	210	635	17·0	14·2	1·42
2,250	227	687	18·4	15·3	1·53
2,500	243	737	19·7	16·4	1·64
2,750	259	785	21·0	17·5	1·75
3,000	275	832	22·3	18·6	1·86
3,250	290	878	23·5	19·6	1·96
3,500	304	922	24·7	20·6	2·06
3,750	318	965	25·8	21·5	2·15
4,000	333	1008	27·0	22·5	2·25
4,250	347	1050	28·1	23·4	2·34
4,500	360	1090	29·2	24·3	2·43
4,750	373	1133	30·2	25·2	2·52
5,000	386	1170	31·3	26·1	2·61
5,500	411	1246	33·4	27·8	2·78
6,000	436	1321	35·4	29·5	2·95
6,530	460	1393	37·3	31·1	3·11
7,000	483	1464	39·2	32·7	3·27
7,500	506	1533	41·0	34·2	3·42
8,000	528	1600	42·8	35·7	3·57
8,500	550	1666	44·6	37·2	3.72
9,000	571	1731	46·3	38·6	3·86
9,500	592	1794	48·0	40·0	4·80
10,000	613	1857	49·7	41·4	4·14
11,000	653	1978	52·9	44·1	4·41
12,000	692	2096	56·2	46·8	4·68
13,000	730	2211	59·2	49·3	4·93
14,000	767	2324	62·3	51·9	5·19
15,000	803	2433	65·2	54·3	5·43
20,000	973	2498	79·0	65·8	6·58
25.000	1129	3420	91·6	76·3	7·63

My purpose, and the drift of my remarks will, probably, be the more readily understood by my at once adducing the tables C and D, and the diagram E, in continuation of the tables A and B, which are published in the Volume of Transactions for the year 1857, pp. 116 and 119,* observing with reference to these tables C and D, that the rate of consumption of coal on which the calculations are based, viz:—2½ lbs. per indicated horse power per hour has been practically realized on continuous sea service, although the ordinary consumption of steam-ships in the Royal Navy, as well as in the best

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[*] See *Journal of the Society of Arts*, Vol. IV., p. 650.

[†] See *Journal of the Society of Arts*, Vol. V., p. 563.

[*] See *Journal of the Society of Arts*, Vol. V., pp. 565 and 567.

vessels of the most celebrated steam shipping companies, is, I believe, at the present time, fully 50 per cent. in excess of that amount; and I may say, that in steam shipping generally, the consumption of coals per knot of distance, with respect of displacement and speed, is double the consumption which these tables, based as they are on an example of existing practice, show to be now practically realisable.

The tables now adduced are as follows:—

Table C, calculated for the speed of ten knots per hour, showing the mutual relations of displacement, power, and the consumption of coals per day, per hour, and per knot, for vessels of a gradation of sizes, from 250 tons displacement up to 25,000 tons, the co-efficient of dynamic performance, deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{Ind.h.p.}}$ being assumed to be 250, and the consumption of coals being assumed to be at the rate of $2\frac{1}{2}$ lbs. per indicated h. p. per hour. On these data, the co-efficient with reference to coals deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{w}$ (w) being the consumption of coals per hour expressed in cwts.) becomes 112·10.

Table D (p. 727) showing the mutual relation of displacement, power, and coals consumed per day, per hour, and per knot for the respective speeds of 10, 15, 20, and 25 knots per hour. The data on which this table is calculated being the same as above described for table C.

Diagram E, (p. 728) showing approximately by scale the nautical mileage consumption of coals for vessels from 1,000 tons displacement up to 25,000 tons, deduced from Table D.

It will be observed that in Table C the tabulated sizes of ships, as determined by their respective load displacements, increase progressively from 250 tons displacement up to 25,000 tons, showing, under assumed conditions, which, however, are justified by the present circumstances of realized advancement in steam navigation, the mutual relations of displacement and coals calculated for the speed of ten knots per hour, as most convenient for a standard of reference. The intended practical use of this Table C is to facilitate mercantile investigation into the dynamic merits of steam ships as locomotive implements of burden by comparing their actual consumption of fuel with the calculated consumption of the ship of corresponding size and speed as recorded in this tabulated standard of comparison, whence the constructive merit of ships, as respects their *working economy of fuel, on which the cost of freight so much depends*, may be relatively ascertained. For example, a certain ship of 800 tons mean displacement attains the speed of 8·8 knots per hour, with a consumption of coals certainly not exceeding 4·3 cwts. per hour, or ·49 cwts. per nautical mile or knot; which (as the consumption of coals per knot varies *cæteris paribus* as the square of the speed) is equivalent to ·63 cwts. per knot at the speed of ten knots per hour. Now by referring to Table D we find that on the assumed data therein referred to, the standard ship of 800 tons displacement, steaming at ten knots per hour, would consume ·77 cwts. of coal per knot. Hence, therefore, it appears that the ship referred to in this instance is superior to the tabulated standard in the proportion of ·77 to ·63, that is, in the proportion of 122 to 100, the superiority with reference to the consumption of coals per knot being 22 per cent.

Again, a certain ship of 3,500 tons mean sea displacement makes a voyage of the speed of 12·88 knots per hour, consuming 83 cwts. of coal per hour, or 6·44 cwts. per knot, which, by the law of dynamics above quoted, is equivalent to 3·88 cwts. per knot at the speed of ten knots per hour; but by referring to the Table of comparison C, we find that the standard ship of 3,500 tons displacement, steaming at ten knots per hour, would consume only 2·06 cwts. of coal per knot. Hence, therefore, it appears that the ship referred to in this instance is inferior to the tabulated standard ship in the proportion of 2·06 to 3·88, that is, in the proportion of 53 to 100, the inferiority with reference to the consumption of coals being 47 per cent.

Thus, by reference to this tabulated standard of comparison (C), we have the means of readily deducing the exact per centage by which ships, as respects the dynamic duty performed with reference to the consumption of coals, differ from each other. I need not dwell on the importance of this consideration as affecting the commercial value of ships.

With reference to Table D, showing the mutual relations of displacement, power, and coals consumed per day, per hour, and per knot for the respective speeds of 10, 15, 20, and 25 knots per hour, the object of this table is to show the extent to which the required engine-power, and the nautical mileage consumption of coals are dependent on the rate of speed, thereby facilitating the adaptation of ships as respects their size and power to the service that may be required of them.

For example, by referring to Table D, we observe that a ship of 5,000 tons displacement, steaming at ten knots per hour, requires 1,170 indicated h. p., and consumes 2·61 cwts. of coal per knot; but to steam 15 knots per hour, the same vessel would require 3,947 ind. h. p., and the consumption of coals would be 5·87 cwts. per knot; hence it appears, that to increase the speed from 10 to 15 knots per hour, the power requires to be increased upwards of three times, and the consumption of coals per knot is more than doubled.

Again, let it be supposed that the weight of the hull of a ship of 5,000 tons displacement fitted for sea amounts to 40 per cent. of the displacement, or 2,000 tons, and suppose the weight of the engines and boilers to be one ton for each indicated h. p., the vessel requiring, as shown by Table D, 1,170 indicated h. p. to attain the speed of ten knots per hour, with a consumption of coal at the rate of 2·61 cwts. per knot, then on those data, the engines, to attain the speed of ten knots per hour, would weigh 117 tons, and the weight of coals for a passage of, say 12,000 nautical miles, would be 12,000 × 2·61 = 31,320 cwts., or 1,566 tons weight, making together, for hull, engines, and coals, 2,000 + 117 + 1,566 = 3,683, and consequently the displacement available for cargo would be 5,000 − 3,683 = 1,317 tons weight. But if it be purposed that the steaming speed shall be at the rate of 15 knots per hour, the required power, as appears by Table D, will be 3,947 ind. h. p., consequently the weight of the engines will be 395 tons, and the maximum displacement available for coals will be 5,000 − 2,395 = 2,605 tons weight, or 52,100 cwt., which, at the tabulated rate of consumption, 5·87 cwts. per knot, would be sufficient only for a passage of 8,876 nautical miles, and this to the utter exclusion of all goods cargo, showing that the ship is inadequate for steaming 12,000 nautical miles at the required speed of 15 knots per hour, though the same ship, if duly fitted with engine-power for steaming at ten knots per hour, would perform the whole passage of 12,000 nautical miles without re-coaling at any intermediate station, and carry 1,317 tons of remunerating goods cargo.

These few examples will, it is hoped, sufficiently illustrate the application and use of Tables C and D in facilitating mercantile inquiry into the capabilities of steamships with reference to the all-important question of consumption of coals; but in order still further to facilitate calculations on this subject, the Diagram E has been prepared, whence, simply by inspection, the consumption of coals per knot, at any rate of speed, may be approximately ascertained for vessels from 1,000 tons displacement up to 25,000 tons, the data on which this diagram has been calculated being the same as that on which Tables C and D are based.

The use and application of this Diagram E is evident; it brings the tables under ocular review, and generalises their application. It is given as an example of a system that admits of being more fully and elaborately developed

TABLE D.

Showing the Mutual Relations of Displacement, Power, and Coals consumed per Day, per Hour, and per Knot, for the respective Speeds of 10, 15, 20, and 25 Knots per Hour. The Coefficient of Dynamic Performance being deduced from the Formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h. p}}$ being assumed to be 250, and the Consumption of Coals being assumed to be at the rate of $2\frac{1}{2}$lbs per indicated horse power per hour.

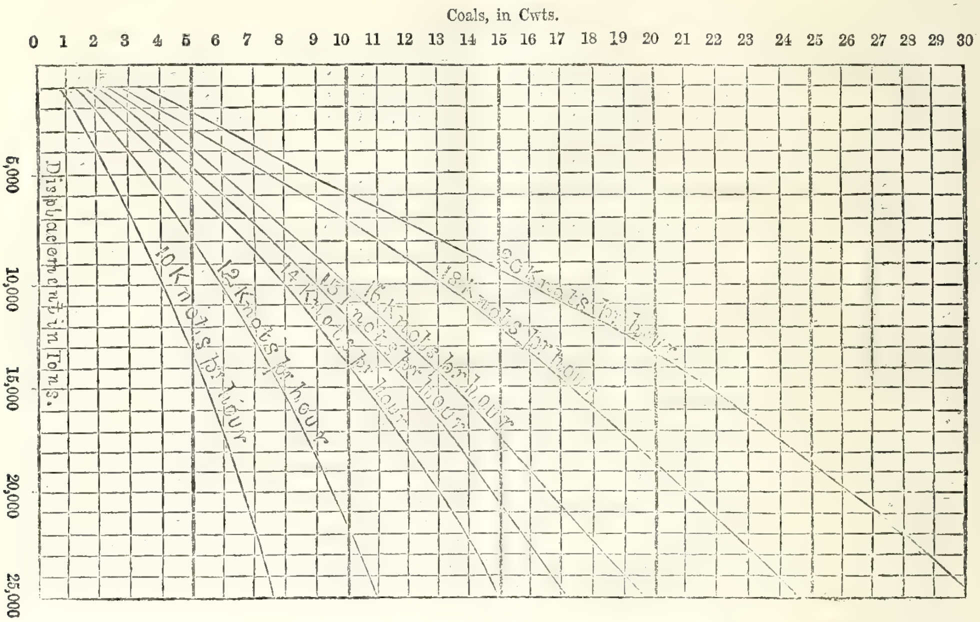
Displacement in Tons, at 35 cubic feet of Sea Water per Ton.	10 Knots.				15 Knots.				25 Knots.				25 Knots.			
	Ind. H. P.	Coals.			Ind. H. P.	Coals.			Ind. H. P.	Coals.			Ind. H. P.	Coals.		
		Per Day.	Pr Hour.	Pr Knot.		Per Day.	Pr Hour.	Pr Knot.		Per Day.	Pr Hour.	Pr Knot.		Per Dap.	Pr Hour.	Pr Knot.
		Tons.	Tons.	Cwt.		Tons.	Cwt.	Cwt.		Tons.	Cwt.	Cwt.		Tons.	Cwt.	Cwt.
1,000	400	10·7	8·92	·89	1350	36·1	30·1	2·0	3200	85·7	71·4	3·57	6250	167	139	5·56
1,200	452	12·1	10·1	1·01	1524	40·8	34·0	2·27	3614	96·8	80·7	4·03	7058	188	157	6·28
1,400	501	13·4	11·2	1·12	1689	45·2	37·7	2·51	4005	107	89·4	4·47	7822	210	175	7·00
1,600	547	14·6	12·2	1·22	1847	49·4	41·2	2·75	4377	117	97·7	4·88	8550	229	191	7·64
1,800	592	15·8	13·2	1·32	1998	53·5	44·6	2·98	4735	126	105	5·25	9248	247	206	8·24
2,000	635	17·0	14·2	1·42	2143	57·4	47·8	3·19	5080	136	113	5·65	9921	265	221	8·84
2,250	687	18·4	15·3	1·53	2318	61·8	51·5	3·43	5495	146	122	6·10	10,731	286	239	9·56
2,500	737	19·7	16·4	1·64	2487	66·6	55·5	3·70	5895	158	132	6·60	11,629	308	257	10·3
2,750	785	22·0	17·5	1·75	2650	70·9	59·1	3·94	6281	168	140	7·00	12,268	328	273	10·9
3,000	832	21·3	18·6	1·86	2808	75·2	62·7	4·18	6656	178	148	7·40	13,000	348	290	11·6
3,250	878	23·5	19·6	1·96	2962	79·3	66·1	4·40	7021	188	157	7·85	13,715	367	306	12·2
3,500	922	24·7	20·6	2·06	3112	83·3	69·4	4·63	7377	197	164	8·20	14,408	385	321	12·8
3,750	965	25·8	21·5	2·15	3259	87·2	72·7	4·85	7724	206	172	8·69	15,086	404	337	13·5
4,000	1008	27·0	22·5	2·25	3402	91·1	75·9	5·06	8064	216	180	9·00	15,749	421	351	14·0
4,250	1050	28·1	23·4	2·34	3542	94·9	79·1	5·27	8396	224	187	9·35	16,392	439	366	14·6
4,500	1090	29·2	24·3	2·43	3680	98·5	82·1	5·47	8722	233	194	9·70	17,036	456	380	15·2
4,750	1130	30·2	25·2	2·52	3815	102	85·1	5·67	9042	240	202	10·1	17,661	473	394	15·8
5,000	1170	31·3	26·1	2·61	3947	106	88.1	5·87	9357	251	209	10·4	18,215	488	407	16·3
6,000	1321	35·4	29·5	2·95	4458	120	100	6·67	10,566	283	236	11·8	20,637	553	461	18·4
7,000	1464	39·2	32·7	3·27	4940	132	110	7·33	11,710	313	261	13·0	22,870	612	510	20·4
8,000	1600	42·8	35·7	3·57	5400	145	121	8·01	12,800	342	285	14·2	25,000	670	558	22·3
9,000	1731	46·3	38·6	3·86	5841	156	130	8·67	13,846	371	309	15·4	27,042	724	603	24·1
10,000	1857	49·7	41·4	4·14	6266	167	139	9·27	14,853	398	332	16·6	29,010	778	648	25·5
12,000	2096	56·2	46·8	4·68	7076	190	158	10·5	16,772	449	374	18·7	36,760	877	731	29·2
14,000	2324	62·3	51·9	5·19	7842	210	175	11·7	18,588	498	415	20·7	46,305	972	810	32·4
16,000	2540	68·0	56·7	5·67	8572	229	191	12·7	20,320	544	453	22·6	39,684	1063	886	35·4
18,000	2748	73·6	61·3	6·13	9272	448	207	13·8	21,980	589	491	24·5	42,294	1150	958	38·3
20,000	2948	79·0	65·8	6·58	9948	266	222	14·8	23,580	631	526	26·3	46,048	1233	1028	41·1
22,000	3140	84·0	70·0	7·00	10,600	283	236	15·7	25,124	673	561	28·0	49,072	1314	1095	43·8
25,000	3420	91·6	76·3	7·63	11,542	310	258	17·2	27,359	733	611	30·5	53,436	1432	1193	47·7

for the purposes of mercantile tabular reference, as is now being done for publication.

Having thus explained the use and application of Tables C and D and the Diagram E, it will be perceived that the task which I have undertaken on this occasion is to show palpably, by comparison with these tabular statements, based on data within the limits of already realised results, taken as a standard, what is the character of steam-ships as respects their locomotive or dynamic capabilities, with reference to the economic performance of mercantile transport service, so far as dependent on the consumption of fuel, thus affording an exposition whereby persons interested in steam shipping, either as owners or directors, or agents, or as charterers of shipping for government or for private service, though unacquainted with the details of marine engineering as a science, may be enabled to arrive at some definite appreciation of the amount of work that may be expected

E.

Diagram showing approximately the Nautical Mileage Consumption of Fuel, for Vessels from 1,000 tons displacement, up to 25,000 tons, the Co-efficients of Dynamic Performance deduced from the formula $\frac{V^3 D^{\frac{2}{3}}}{\text{ind. h. p.}}$, being assumed to be 250, and the consumption of coals being assumed to be at the rate of 2½ lbs. per ind. h. p. per hour.



of steamers; that is, the weight of cargo they will carry, and the length of passage capable of being performed at any definite speed, for, as before observed, the dead weight of cargo that a ship will carry is equal to the tons' weight of water displaced between the light and load water-lines of the ship, less the weight of coals required for the voyage, and which for long voyages commonly amounts to four times the weight of cargo chargeable as freight, and it constitutes the limitation of distance which the ship is able to run under steam at a given speed. This inquiry is therefore essential to a due appreciation of the economic consequences which are involved in progressive variations of steam ship speed, especially as respects the high rates of speed, which are occasionally professed, but which are seldom realized, simply because there has been no recognised exposition, whereby such pretensions may be judged of with reference to the required consumption of fuel. In short, regarding this matter as a public cause, affecting as it does the pecuniary interest of the public to the extent of millions sterling per annum, my object is to promulgate, through the medium of the notoriety which every inquiry obtains upon its being brought before the "British Association for the Advancement of Science," a Mercantile Steam Ship Expositor, by reference to which, as a standard of comparison, the good or bad qualities of steam shipping may be determined; and this surely is a public cause, for by the operation of this scrutiny which such a system of comparative exposition may be expected to inaugurate and popularise, steamers will soon become marketable, with reference, in great measure, to their capabilities for economic transport service, according to the speed that may be required; and under the influence of this scrutiny all bad types of form and vicious adaptation of mechanical system, will be eradicated; incompetency in steam-ship management will become gradually eliminated, and the mercantile transport service of the country being then performed exclusively by good, well-appointed, and well-managed ships, would be performed at a minimum of cost to the shipping interests, and consequently to the best advantage for the interests of the public. Hitherto the dynamic character of steam-ships has been a mechanical problem enveloped in undefined and even delusive terms of shipping and engineering art; consequently its determination has not been based on any recognized principles of calculation. Hence the dynamical character of shipping has been a mystery—a matter of mere assertion on the one hand, and of credulity on the other. But mystery being unveiled, commercial vision will be opened, and competition, in shipping as in any other well understood and open field of public enterprise, will ensure the mercantile transport service of the country being performed to the best advantage, and it will gradually establish and preserve the just equilibrium of trade as between the carriers and consumers of all the sea-borne productions of the earth.

Woolwich Dockyard, 1st September, 1859.

WESTMINSTER BELL.

A writer in the *Times* says:—

"Drill a hole at the extreme end of the crack, and run a whip-saw from the rim of the bell along the course of the fracture, and Big Ben will be himself again. I have tried this plan with perfect success.

"The reason a cracked bell sounds like no other earthly music is owing to the surfaces of the crack grating and hitting against each other with every vibration passing through them, and thus breaking and destroying the continuity of the wave.

"The key or pitch will not suffer, and the bell itself be rendered less likely to break or crack again, as the tension of its particles will be to this extent at least liberated. I am convinced the timbre or quality of tone will not be lessened, and as the expense will be a mere trifle, it will be worth trying, if only as an experiment, not likely again to offer on so large a scale."

Such a course, it is understood, is frequently adopted with small bells, and has been found to answer perfectly.

Home Correspondence.

LONDON MECHANICS' INSTITUTION.

Sir,—I have the pleasure to inform you that the purchase of our landlord's interest in the buildings occupied by this Institution has been this day completed, and Lord Brougham and his co-trustee are thus released from their liability to pay a rent of £229 per annum for more than a hundred years. This gratifying result is in a great measure due to the invaluable assistance which we obtained from the press at an early period of our labours. But although much has been accomplished, much still remains to be done, as the subscriptions amounted to about £2,000 only, out of the £3,500 required, and the £1,500 additional having been raised by mortgage, Lord Brougham and his co-trustee have been obliged to enter into a covenant for payment of the amount. In order to complete the work which they have thus far carried on successfully, the Committee propose to raise further subscriptions, sufficient to pay off this debt of £1,500, and the necessarily large legal expenses incurred by the trustees, and in this effort they trust to receive a continuance of the powerful assistance which the press has hitherto afforded them.

I have the pleasure to state that the Institution is in an improving condition. There are now upwards of 340 subscribers, besides several hundred persons attending classes in geometry, book-keeping, French, Latin, German, arithmetic, English grammar, drawing, and many other branches of education. There can be no doubt that the utility of the Institution will be greatly increased, now that it has been liberated by the generosity of the subscribers from the payment of £125 of annual rent. £75 more would be extinguished by the payment of the mortgage debt.

I am, &c.,
(On behalf of the Donation Fund Committee),
THOS. J. PEARSALL, Sec., &c.

London Mechanics' Institution,
Oct. 4, 1859.

THE WESTMINSTER CLOCK.

Sir,—So soon as the quarter-chimes had been set going and the hands had been placed on all the dials, I thought it desirable that some efficient steps should be taken to obtain a correct rate of the clock's performance, and therefore proposed to Mr. Quarm to fix up an astronomical clock in his office, at the Houses of Parliament. To this proposal Mr. Quarm at once acceded, and cheerfully undertook the task of observing the rates.

One of the finest astronomical clocks that I have produced was consequently selected, and placed in Mr. Quarm's office on 28th September; and in order to afford additional confidence in the results, I attended personally to the fixing, and adjusting of the pendulum and arc spring, &c. The whole of the adjusting did not occupy two hours, and it may be remarked that the clock at once went to absolute mean time within eight-tenths of a second a day without subsequent regulation. The next step was to ascertain by trial the degree of accuracy which Mr. Quarm was likely to attain in taking the rates; several comparisons of the first blow of the quarter chimes with the astronomical clock were consequently made by him, simultaneously with those made by myself, and the results each time were within two-tenths of a second.

These arrangements having been completed, the following rates of the Westminster clock were taken by Mr. Quarm, from the first blow of the quarters and the first blow of the hour:—

1859.	Time of Observation.	Westminster Clock, Fast or Slow of Astronomical Clock.	Difference in Gain or Loss of Westminster Clock from one observation to the next.
	H. M.	s.	s.
Sept. 29.	10 30	S. 9·8	
,,	10 45	S. 10·2	L. 0·4
,,	11 0	S. 4·0	G. 6·2
,,	12 0	S. 4·0	0·0
,,	12 15	S. 2·6	G. 1·4
,,	12 30	S. 10·2	L. 7·6
,,	1 0	S. 4·4	G. 5·8
,,	1 30	S. 12·8	L. 8·4
,,	1 45	S. 12·8	0·0
,,	2 0	S. 4·2	G. 8·6
,,	2 15	S. 2·4	G. 1·8
,,	2 30	S. 10·2	L. 7·8
Sept. 30.	10 45	S. 9·0	
,,	12 0	S. 4·0	G. 5·0
,,	12 15	S. 6·2	L. 2·2
,,	12 30	S. 12·2	L. 6·0
,,	12 45	S. 8·4	G. 3·8
,,	1 45	S. 9·0	L. 0·6
,,	3 0	S. 6·2	G. 2·8
,,	3 30	S. 11·6	L. 4·4
,,	4 30	S. 8·0	G. 3·6
Oct. 1.	10 30	S. 11·6	
,,	11 0	S. 3·6	G. 8·0
,,	12 30	S. 7·6	L. 4·0
,,	1 0	S. 5·0	G. 2·6

No rates were taken after this time, in consequence of the hour and quarter parts being stopped, on account of the fracture of the great bell.

It will be observed, in the foregoing table, that instead of the clock proclaiming Greenwich time within one second in 24 hours, according to the stipulated conditions, it occasionally varies more than eight seconds in a quarter of an hour.

In order to eliminate the error of the astronomical clock I have looked over several years' rates of it, taken by the late Mr. Belville, of the Greenwich Observatory, to ascertain the probable quantity, and found it to amount to rather less than two hundredths of a second for the longest interval between the observations recorded in the Westminster rates.

Besides the above, I have other rates which were previously taken by myself, with a chronometer, on Sept. 12, 13, and 28, and they show that the Westminster clock did not indicate time more accurately on those days.

In my letter, dated July 30, published in the *Mechanics' Magazine* and *Journal of the Society of Arts* (p. 643), it is stated, as my settled conviction, founded on a patient and elaborate investigation of the going part, that the clock could not possibly keep time within the promised limit unless the construction were radically altered and the principle introduced which I then described. It will now be seen that the amount of error shown in the present rates more than fulfils the quantity I then prophesied.

E. T. LOSEBY.

11th October, 1859.

P.S.—To those not intimately acquainted with horology it may be explained that the arc-spring is an improvement for causing the long and short arcs of vibration of the pendulum to be performed in equal times. It was invented by me, and submitted to trials under the superintendence of the Astronomer Royal at the Greenwich Observatory, during the years 1851 and 1852, and Mr. Airy's reports thereon to the Government may be found in Parliamentary Return to the House of Commons, No. 1006, Session, 1853.

Proceedings of Institutions.

Crosby Hall (Evening Classes).—On the 26th Sept., Mr. Alderman Carter presided in Crosby-hall, and the Annual Report having been read, the Session was declared to have commenced. A vote of thanks to the Alderman was proposed by Mr. Shipton, of the Young Men's Christian Association, and seconded by Mr. Whittington. The number of tickets issued on the first day of term was 100, and on the second day 113. The report records the continued success of the classes, and the steady progress of the cause of adult education. Influenced by the example set in the metropolis, there are numerous towns and villages which have made some effort to establish, in a systematic form, either evening schools or evening classes. In some cases the exertions have been very limited; but during the winter months, at least, the clergy have thrown open their school-rooms for this purpose; and in innumerable cases have dedicated their time and energies, for one or more evenings in the week, to collect around them the young men of the place, and supply them with that particular kind of knowledge which they felt they most required. In the Metropolitan Evening Classes the number of the members has been increased, but the receipts from them are nearly identical with those of 1857-8, viz. :—Michaelmas Term, 796 members; Lent Term, 816; Trinity Term, 654;—producing £614 1s. 2d. Thirty lectures have been delivered, and two choral demonstrations and three elocutionary entertainments held; and all who have taken part in these deserve the best thanks of the community. The Evening Classes this year obtained the honour of the personal patronage of H.R.H. the Duke of Cambridge, who presided at the festival in Willis's-rooms, on the 6th of April; and who, by his speech on the occasion, attracted public attention to the duty of encouraging efforts of this character to render the young men of England more fitted for the duties that await them. The immediate result of this was a liberal subscription round the table; and the effect, less seen but not less real, was the encouragement to all parties actively concerned to continue their labour of love. The great expense of rent and taxes, as in former years, was the difficulty with which the committee had to contend. The young men have given no trouble; the class teachers have been faithful, punctual, and diligent; the lecturers have been generous and talented; but with so great a demand upon the purse it has not been found possible to render these classes self-supporting; and the Committee has again been compelled to resort to the reserved fund for help, in the hopes of finding some day occupation of the rooms, which would eventually prove remunerative, and at the same time provide fresh pupils for the classes. The Report says that it may well be doubted whether institutions of this character can ever sustain themselves while they use their dwelling both night and day, and are consequently taxed with the entire rent; whereas their receipts are derived only from the evening occupants. Under these circumstances, the idea of leaving Crosby Hall appears to be in contemplation. The importance of the classes, says the Report, is now so widely felt, and they have taken such deep root in the pubilc mind, that there is every reason to hope their class rooms will be multiplied, and their reading room transplanted without injury; and though slow to make the change unless necessary, the Committee have its eye on localities and buildings which will be found not less convenient or accessible for the young men of London. Under the present direction there are larger French and German classes than can be found elsewhere in London. There is no other institution with such extensive or well arranged systematic teaching in mathematics, in languages (ancient and modern), and in the requisite training for mercantile pursuits. Since September last, Mr. E. G. Clarke, A.A., has been appointed to a clerkship in the East India House, after a competitive examination; and at the distribution of prizes and certificates to students of Evening Classes at King's College, nine members of the Metropolitan Evening Classes obtained eight of the former and twelve of the latter; and at the Society of Arts Examination in May last, two prizes and 33 certificates were awarded to members of the Evening Classes. The following are the subjects taught in the classes:—French, German, Elocution, Latin, Arithmetic, Book-keeping, Spanish, Vocal and Choral Music, Writing, English Grammar, Algebra, Concertina, Geometry, Italian, Chemistry, English History, Greek, Shorthand, Geography, Bible (free). There are now upwards of 800 students.—On Friday, the 7th instant, there was a public meeting at Crosby Hall, for the purpose of distributing the prizes and certificates obtained this year at the Society of Arts, by members of the Metropolitan Evening Classes for Young Men. The Right Hon. the Lord Mayor occupied the chair, and was supported by the Right Rev. the Lord Bishop of British Columbia; the Rev. Henry Mackenzie, Prebendary of Lincoln; the Rev. M. W. Lusignan; Mr. Thos. Winkworth, Vice-Pres. of the Society of Arts; Mr. D. Blenkharm, and the Hon. Secretaries, &c. There were many ladies present.—The Rev. Charles Mackenzie, one of the Hon. Secretaries, congratulated the meeting upon the presence of the Lord Mayor and other distinguished friends of the Evening Classes, and upon the honourable position which the members had obtained at the recent examination by the Society of Arts. It appeared that two prizes and thirty-three certificates had been awarded to twenty-five members of the Institution in May last, the prize-men being Mr. Samuel Lee Cressall, first prize, German; and Mr. Henry Legg, second prize, French. These gentlemen, having been separately introduced, were suitably addressed by the Lord Mayor, and were presented with their certificates and the cheques of the Society for the amount of their prizes. In consideration also of Mr. Cressall's having obtained a first prize, a cheque for five guineas had been presented by the Council of the Society of Arts to the Metropolitan Evening Classes. In the course of his Lordship's address to Mr. S. L. Cressall, he observed upon the advantages conferred on the Institutions in Union by the systematic examinations instituted by the Society of Arts, and enlarged upon the benefit to young men, both morally and commercially, who acquired a thorough knowledge of a new language.—At the suggestion of Mr. Mackenzie (who was anxious to spare the Lord Mayor, in his present weak condition of health, all unnecessary fatigue), the remaining certificated members were grouped around the chair, and received their respective papers, with a few earnest and affectionate words of approbation and encouragement. A number of books were handed by the Chairman as the Whittington Prize (in recognition of the services rendered to the members of that class by the Rev. R. Whittington), to Mr. Brady, who was reported by Mr. Reynolds, the teacher of the class and donor of the prize, to have been his most industrious and most successful pupil. Four other books were then given to four other gentlemen who had applied themselves to the same branch of study. At this stage of the proceedings, the Lord Bishop of

British Columbia rose to express the warm interest he felt in the Institution generally, and in the particular proceedings of that evening. He thought great credit was due to these young men, who withstood the temptations to idleness and frivolity offered in a thronged metropolis, that they might wisely devote their time to the pursuits of literature and the improvement of the mind. He was himself about to visit a very distant part of her Majesty's dominions, but he hoped to carry out with him, and engraft on his adopted country, many of the wisest institutions of Great Britain; and the work which was going on there was akin to that which it would be his special duty to promote, viz., the higher education of the mind, and the preparation, through a civilising and elevating process, for the reception of revealed truth and the exhibition of Christian life. He warmly congratulated the young men on the success they had achieved, and reminded the meeting that these youthful candidates for honour had been placed in competition, not only with the whole of London, but with the aroused intelligence of the various Institutions through the length and breadth of the land; and he urged upon the members the importance of time as a preparation for eternity, and the responsibility involved in their improved opportunities.—The Rev. Henry Mackenzie called on the meeting to acknowledge the kindness of the Lord Mayor in giving his presence on the occasion; and expressed his own entire and hearty sympathy with the young men of London. He alluded feelingly to the rumour that the Classes were about to leave Crosby Hall on account of the expense of rent, and expressed a strong conviction that there were many merchant princes in the City who, though grudging the time to manage such an Institution, would not hesitate to give large assistance, rather than risk the dispersion of such extensive Classes, that were conferring incalculable benefits, morally, socially, politically, and spiritually, upon so many hundreds of young men engaged in the warehouses, counting-houses, shops, and factories, immediately around them.—The vote of thanks was seconded by the Rev. W. Lusignan, one of the earliest friends of the Institution, who alluded to the support that the Lord Mayor had given, ten or twelve years ago, in his character as a member of the Common Council, when a grant of £50 had been made to this Institution, in its infancy, by the Corporation of London.—After a suitable acknowledgment, and a suggestion that the young men should ask their employers to support the Committee in their attempt to retain Crosby Hall, the Lord Mayor retired, and his place was occupied by the Bishop of Columbia.—The Rev. C. Mackenzie and the Rev. R. Whittington, the Honorary Secretaries, proposed and seconded a vote of thanks to the Council of the Society of Arts, for the assistance given to the cause of general education by their admirable system of Examinations; and in doing so, paid a high tribute to the fidelity and fairness with which the Examiners performed their work.—This was acknowledged by Mr. Winkworth, a Vice-President of the Society, who begged to thank the meeting for their cordial appreciation of the system of Examinations originated by the Society of Arts, and now so successfully and usefully adopted by the Universities and several departments of Government. The Crosby Hall Evening Classes had, as usual, carried off more than their fair proportion of prizes, and if not quite so many in number as last year, the competition being greater and the prizes offered rather fewer, the quality of merit was not deteriorated. If the Society might venture to claim a diadem of honour for inaugurating so important a social desideratum, the Crosby Hall Classes certainly supplied one of its most brilliant gems.—Thanks to the Tutors were then proposed by Mr. E. G. Clarke, A.A. (who in the course of last year had obtained a clerkship at the East India House, after a competitive examination, and who on every previous year had been one of the prize men at the Society's Examinations), and seconded by Mr. Brady, who paid a special tribute to Mr. T. Reynolds and the Rev. Mr. Potter. This was acknowledged by Dr. Zerffi, the German teacher, who was received with great applause; and after a cordial vote of thanks to the Bishop of Columbia, the meeting was dismissed with his Lordship's blessing.

London Mechanics' Institution.—The distribution of the Society of Arts' certificates to the members of the London Mechanics' Institution took place on Wednesday, the 5th inst., in the presence of a crowded auditory. Mr. T. A. Reed, who distributed the certificates, alluded to the beneficial effects of the examinations instituted by the Society of Arts, explained their *modus operandi*, and commended them to the attention of the members. He referred to the work of preparation as a beneficial mental exercise, and expressed a hope that the result of the last examination would give to the successful competitors the encouragement which was due to diligent study, and stimulate them to renewed efforts. Eight out of the nine members passed by the Local Board had succeeded in obtaining one or more certificates, a proportion honourable alike to the Institution and the candidates. Prizes of books were also distributed by Mr. Reed to the successful competitors at the recent examination by the Local Board of several of the classes of the Institution; and it was announced that Mr. Vallentine, a member of the Board, had offered the like number of prizes to be competed for next year. The following candidates received their certificates:—J. B. Rundell, Geometry and Mensuration (1st class), with first prize; James Dickie, 3rd class, Arithmetic and French; F. Aumonier, 2nd class, French; W. W. Woolnough, 3rd class, Arithmetic and French; R. E. Woods, 2nd class, Geography; F. Moore, 3rd class, Book-keeping; Thomas Shinn, 2nd class, Chemistry; W. M. Medcraft, 3rd class, Geography. The prizes of books were awarded to Mr. A. Sheill, for writing; Miss Wallington, for English grammar; Mr. Davidson, for landscape drawing; and Mr. Rathbone, for phonetic short-hand.

PATENT LAW AMENDMENT ACT.

APPLICATION FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 7th*, 1859.]

Dated 26th July, 1859.

1730. D. B. Hale, New York, U.S.—A new and useful garment for ladies' wear, being a combined waist or body and a skirt supporter and bustle. (Partly a com.)

Dated 5th September, 1859.

2024. J. B. H. H. R. Barre, and J. B. M. E. Barre, Paris—Imp. in cutting out or engraving metals and their alloys.

Dated 9th September, 1859.

2058. M. M. Jackson, Zurich, Switzerland—Imp. in generating steam for condensing engines.

Dated 13th September, 1859.

2086. E. A. F. Lebourgeois, Suresnes, France—An improved machine for providing with pin points the blocks employed for surface printing on calico, paper, or other similar materials.
2088. A. B. Freeland, Camden-road Villas, Middlesex—Imp. in preparing hay and clover for food for horses and other animals.

Dated 14th September, 1859.

2092. J. Marritt, Sutton, Yorkshire—An improved double-action rotating harrow.
2094. R. C. Rapier, Newcastle-upon-Tyne—Imp. in the construction of steam boilers.
2096. N. Defries, 5, Fitzroy-square, Middlesex—Imp. in gas meters.
2098. E. Applegath, Dartford—Imp. in machinery for printing and for cutting printed paper into sheets.

Dated 15th September, 1859.

2100. J. Addenbrooke, London—An apparatus for wrapping, folding, or packing up goods or parcels.
2102. J. T. Wood, Strand, Westminster—Imp. in printing and embossing dies.
2104. J. P. Clarke, King-street Mills, Leicester—Imp. in the manufacture of spools or reels for the winding on of cotton, linen, thread, silk, or other fibrous materials.

Dated 16th September, 1859.

2106. J. Bottomley and A. H. Martin, North Brierley, near Bradford, Yorkshire—Imp. in means or apparatus employed in weaving.

2108. B. Lauth, Manchester—Imp. in the manufacture of rails for railways.
2112. J. Beck, Coleman-street, London—Imp. in stereoscopes.

Dated 18*th September*, 1859.

2114. J. Luis, 1B, Welbeck-street, Cavendish-square—Imp. in mechanical hammers. (A com.)
2116. J. Luis, 1B, Welbeck-street, Cavendish-square—An automaton bell for the prevention of collisions at sea. (A com.)
2118. J. Luis, 1B, Welbeck-street, Cavendish-square—Imp. in cooling apparatus for liquids, especially beer. (A com.)
2120. J. J. Kerr, Twickenham, Middlesex—Imp. in the manufacture of cartridges containing shot.

Dated 19*th September*, 1859.

2124. E. H. Taylor, Saltney, Chester—Imp. in the mode of securing the bolts in fish-joint and other fastenings for rails on railways.
2126. J. Hawkins and C. Hawkins, Walsall—Imp. in fly presses to be worked by steam, water, or other power.
2128. R. McCall, Dublin—Imp. in obtaining precipitates of copper, parts of which improvements are applicable to the production of yellow ochre.
2130. T. C. Eastwood, Bradford—Imp. in means or apparatus for preparing and combing wool, cotton, and other fibres.
2134. W. Clar, 53, Chancery lane—Certain imp. in electro magnetic telegraphs. (A com.)
2136. J. Court, Brompton-row, Middlesex—Imp. applicable to gas and other lamps and lights, and also gas stoves for effecting more complete combustion therein.

Dated 20*th September*, 1859.

2140. W. McIlwraith, Glasgow—Imp. in weaving.
2142. A. Lamb, Southampton—An improved method of heating the feed water for boilers.

Dated 22*nd September*, 1859.

2155. T. Field, 5, Rose-gardens, Hammersmith—A new means and system for cleaning, ironing, pressing, and glazing women's stays, corsets, supporting bands, men's jackets, coats, trousers, and waistcoats, chintzs, laundry work (that is to say goods and articles generally washed by laundresses), window blinds and textile fabrics generally.
2157. J. Dales, 11 and 12, Gresham-house, Old Broad-street, London—Imp. in purifying sewage and other impure waters, and in separating therefrom materials suitable for use as manure, and also the preparation of a substance to be employed for such purposes.

Dated 13*rd September*, 1859.

2159. L. Castelain, 53, Newman-street, Oxford-street, and C. F. Vasserot, 45, Essex-street, Strand—A novel application of a plant to the manufacture of pulp for paper and millboard, and in the method of treating the same when so applied.
2161. C. J. Parry, Manchester—Imp. in diamond shirt fronts.

Dated 24*th September*, 1859.

2163. J. J. Bourcart, Manchester—Imp. in machinery or apparatus for opening, cleaning, carding, and drawing cotton and other fibrous materials.
2165. A. R. Le Mire Normandy, 67, Judd street, Brunswick-square—Imp. in the application of steam for cooking food.
2167. C. Lambert, Sunk Island, Yorkshire—Imp. in machines or apparatuses for cutting and pulping food for cattle and other like purposes.
2169. T. Robinson, St. Helen's, Lancashire—Imp. in steam hammers.
2171. J. T. Pope, Burslem, Staffordshire—Imp. in the manufacture of marbles.
2173. J. Opie, Tremar, Cornwall—Imp. in instruments or apparatus for charging holes in blasting operations, parts of which are also applicable for like purposes.

Dated 26*th September*, 1859.

2175. R. W. Sievier, Upper Holloway, Middlesex—Imp. in the means of creating a draught, so as to remove the gases which may be produced by combustion, or from places where gases may be generated where they may be detrimental to health.
2177. D. White, 18, High Holborn—Increasing the illuminating and heating powers of gases, and regulating the flow of gases, and improvement in the material for gas meters, and improvement in glass and cylinder holders.
2179. J. Villet-Collignon and L. George, Paris, 29, Boulevart St. Martin—Imp. in typography.

Dated 27*th September*, 1859.

2181. W. Airey, Brighouse, and J. Clayton, Golcar, Yorkshire—Imp. in machinery or apparatus for preparing silk, wool, cotton, flax, or other fibrous substances for spinning.
2183. T. Birtwell and R. Marshall, Padiham, Lancashire—An improved arrangement of apparatus to facilitate the putting on of boots to the feet.
2185. J. S. Parfitt, Paris, 60, Boulevart de Strasbourg—An improved machine for heading bolts, rivets, screws, and other similar articles requiring to be headed whilst hot.
2187. T. Beards, Stowe, Buckinghamshire—Imp. in ploughing and cultivating land by steam power, and in machinery used for such purposes.

Dated 28*th September*, 1859.

2189. W. Maltby, De Crespigny park, Camberwell—An improved mode of producing starch-gum.
2191. E. K. Dutton, Sale, Chester—Certain imp. in "governors," particularly adapted to steam engines.
2193. T. Sutton, St. Brelade, Jersey—Imp. in the construction of apparatus for taking photographic pictures, consisting of and entitled "an improved panoramic lens for taking photographic pictures.
2195. W. H. Phillips, Nunhead, Peckham, Surrey—Imp. in apparatus for generating and regulating heat, applicable to culinary and other purposes.
2197. G. Evans and E. Huxley, 12, Old Cavendish-street, Cavendish-square, Middlesex—Imp. in the construction of hernial trusses and pads adapted to surgical purposes generally.
2199. M. L. J. Lavater, Strand—Imp. in apparatus known as injection bottles, and in pneumatic discs used in apparatus for adhering to glass and other impermeable substances.
2201. D. Stewart, Newcastle-on-Tyne—Imp. in presses used for pressing goods.

Invention with Complete Specification Filed.

2154. E. B. Dimock and J. H. Baker, Ware House Point, Connecticut, U.S—A new and useful improvement in mechanism or apparatus for drying woollen or other cloths. (A com.)—21st September, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, October* 7*th*, 1859.]

October 7*th*.

866. A. Chaplin.
876. W. Campion.
877. M. Wheeldon.
879. M. A. F. Mennons.
881. W. Hooper.
882. W. Hooper.
888. T. Barnett, H. T. Sourbuts, and W. Loynd.
890. J. Hawkins.
893. J. Martin.
905. W. Rowan.
906. R. A. Brooman.
907. W. S. Clark.
909. J. Marland.
912. P. Aitchison.
918. M. Castay.
921. R. A. Brooman.
922. S. Tatton.
923. R. Emery.
928. W. Craft and T. Wilson.
929. A. R. Johnson.
930. J. A. Coffey.
932. J. L. Stevens.
933. J. Hughes, W. Williams, and G. Leyshon.
946. G. Abeillou.
952. H Barrow.
956. W. Clark.
967. J. Luis.
1045. W. E. Newton.
1050. J. H. Johnson.
1067. R. Harrington.
1120. J. G. Willans.
1204. W. S. Thomson.
1270. F. J. Bramwell.
1297. C. E. Amos.
1318. T. Wilson.
1412. W. Sellers.
1552. G. Baker.
1572. E. A. Wood.
1592. A. V. Newton.
1597. W. E. Newton.
1843. J. D. Bryant.
1872. J. Stuart and W. Stuart.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October* 7*th*, 1859.]

September 26*th*.
2266. W. Smith and N. F. Taylor.
October 4*th*.
2389. G. W. Varnell.
October 5*th*.
2352. F. Whitehead.
2358. D. Joy and W. Holt.

[*From Gazette, October* 11*th*, 1859.]

October 8*th*.
2380. W. Rennie, junr.
October 9*th*.
2364. T. King.
2371. L. J. Jordan.
2414. G. Collier.
2446. J. F. Deshayes.
2456. J. Lacassagne & R. Thiers.

Patent on which the Stamp Duty of £100 has been paid.

[*From Gazette, October* 7*th*, 1859.]

October 1*st*.
324. T. Restell.
October 3*rd*.
234. J. Balmforth, W. Balmforth, and T. Balmforth.
October 4*th*.
280. W. Bissell.
565. W. H. F. Talbot.
October 5*th*.
330. H. Moorhouse.
400. S. Pincoffs & H. E. Schunck.

[*From Gazette, October* 11*th*, 1859.]

October 6*th*.
282. J. Blair.
292. S. Rainbird.
413. C. T. Judkins.
448. J. Otams.
October 7*th*.
324. T. Restell.
October 8*th*.
545. C. B. Normand.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,200.	Sept. 26th.	Iron Keg or Cask, for Packing Paint or other merchandise....................	Charles Wall	Newton-street, Birmingham.
4,201.	,, 27th.	Economising and Purifying Gas Burner ...	Armstrong and Hogg...	30, Lothian-road, Edinburgh.

Journal of the Society of Arts.

FRIDAY, OCTOBER 21, 1859.

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COUNCIL.

The following Institutions have been taken into Union since the last announcement:—

Bath Athenæum.
Newington Working Men's Association.
Upper Norwood and Crystal Palace Working Men's Association.
West Bromwich Young Men's Christian Institute.

LEEDS YOUNG MEN'S CHRISTIAN INSTITUTE.

The Prizes and Certificates awarded by the Council of the Society of Arts to the Candidates belonging to this Institution, who were successful at the last Examination, were distributed at the annual soirée which was held in the Victoria Hall, on Monday evening last, the 17th instant, under the presidency of the Earl of **Shaftesbury**. About 1,200 persons were present. A deputation from the Society of Arts, consisting of Sir Thomas Phillips, F.G.S., Chairman of the Council, and Mr. Harry Chester, Vice-President, attended at the invitation of the Committee of the Institute. There were also present the Right Hon. W. Cowper, M.P., Sir Peter Fairbairn, the Hon. A. Kinnaird, M.P., Mr. Edward Baines, M.P., Rev. Canon Stowell, Mr. J. G. Marshall, Mr. John Gott, Mr. W. Shipton, of the Young Men's Christian Institute, London, Mr. John Rand, of Bradford, Rev. J. Blomefield, Rev. J. H. F. Kendall, President of the Holbeck Church Institute, Rev. Dr. Brewer, Mr. Hole and Mr. Pickering, of the Leeds Mechanics' Institute, Mr. Barnett Blake, Agent of the Yorkshire Union, Mr. C. S. Spence, &c. The Committees of the various Institutions in the neighbourhood, in union with the Society of Arts, were invited to attend.

Mr. **Spence**, one of the hon. secretaries, read the report. After congratulating the meeting on the distinguished presidency under which they were assembled, the report stated that there were at present eight honorary members connected with the Institution, 247 regular members, and 182 subscribers; total, 437 members and subscribers. The committee regretted that the Institution had not yet reached a self-supporting basis, and they urged the desirability of individual action in endeavouring to increase the number of members. The library was not large, but the books it contained were of a solid and useful character. The total number of volumes was 956; the issues during the year have been 5,658. At the last Examination of the Society of Arts, the Institute attained the proud position of first in England with respect to class instruction, and as a mark thereof the Local Board received £10 from the Society. Out of 36 competitors from the Institute, 31 were successful. Several of the pupils in addition had competed at Durham, and that evening there would be distributed the certificates and the degree of literate of Durham which had been obtained at the examination in that city within the last few days. The report concluded by an appeal for increased support on behalf of the Institute.

The Right Hon. W. **Cowper**, M.P., moved the adoption of the report, and in doing so, said he had lately attended the Social Science Congress at Bradford, where they had been taking as comprehensive a survey as they could of the wants of the present day with regard to the social condition of the population. During the discussions they found, with respect to education, that there was nothing more wanted than some further assistance to the education of persons of the middle classes. Great efforts had been made by the Government in improving the education of the lower classes, and improvement had been made with regard to the higher education of the Universities; and they had also found that great improvement was taking place in the education of the middle classes, but still further efforts were required in that direction more than in any other, and therefore he felt that a meeting like that one was a practical exemplification of what at Bradford they had found to be so necessary. They learnt from the report that the Institution had been directing its attention specially to evening classes, and he was glad to hear that such a marked and signal success had attended the studies of the young men belonging to the Institution. Now, he was of opinion that those evening classes, followed as they were by Examinations and the distribution of prizes and certificates, offered just what was most required, in order to improve the education of those connected with them. By teaching in classes and by lectures, Mechanics' Institutions were a real and valuable assistance to the cause of education generally. Now the great value of such Institutions was that they provided for the leisure of young men, and he believed that there was no sphere in which that struggle between good and evil which was going on in the breast of everyone, was more decided than by the character of the amusements in which they indulged. The best sort of recreation would be found by young men in literature, in the acquisition of knowledge, in improving their faculties, and particularly in directing their studies to those special subjects which were most likely to have a bearing on their future callings. The real recreation worthy of an intelligent and noble-minded people was the recreation derived from books, and he hoped that the library of the Institution would receive such additions as would enable it to afford still further means of study and recreation to its members. He was certainly glad to find that young men had the opportunity and the good sense to associate themselves together and combine on the ground of agreement in religious opinion. He wished to see their religious opinions and feelings influencing more the daily life of the workshop, the market, and all the occupations of life, and he therefore looked with satisfaction on an educational association founded upon union in religious opinions. After dwelling upon the temptations to which young men were subject, and to the value of these institutions as a means of preventing their falling into improper habits, the hon. gentleman expressed his hope that the institution would receive that success which it deserved. There was nothing sectarian, nothing narrow or bigoted in that Association, but its foundation was the broad basis of the truths which were found in the Bible, and which were acknowledged by so large a body of Christians in this country—principles which were strong enough to carry them safely through the world, principles which would give them all one common bond of sympathy and union. He concluded by moving the following resolution:—

> "That the report now read be adopted, and that this meeting expresses its satisfaction at the growing interest felt in the religious and educational agency of the institution, and for the blessings which have been so largely vouchsafed on its efforts during the past year."

The Rev. J. **Blomefield** seconded the resolution, which was also supported by the Hon. A. **Kinnaird**.

The motion was then put, and carried unanimously.

The Rev. Canon **Stowell** moved the next resolution:—

> "That this meeting views with the warmest approbation the object for which the Leeds Young Men's Christian Institute was established, and earnestly commends the numerous advantages offered by it to those who are interested in the spiritual and intellectual welfare of Christian young men."

This Institute differed from Mechanics' Institutions, Lyceums, and Working Men's Colleges (all no doubt good in their way) in this, that whilst the latter were confined to secular knowledge, this made secular knowledge merely the stepping stone to spiritual knowledge. It was sometimes charged against the clerical order that they were jealous of secular knowledge and advancement, but this was not so. They were were not jealous of secular knowledge when sanctified by Christian principle, but they were jealous of mere progress in intellect, in art, in science, and metaphysics, and just on this account, that they believed that rapid progress—high pressure—was dangerous unless under the control and influence of Christianity. He wished not to be misunderstood—he rejoiced in all those wonderful discoveries of science, and those marvellous applications of steam and inventive power of which their age was so fertile, but he did bid them beware of being carried away by the mere love of secular knowledge.

Mr. E. Baines seconded the resolution. He said that surrounded as he was by gentlemen representing the Society of Arts (to which they were deeply indebted for its scheme of examinations), the Parent Society of the Young Men's Christian Institutes in London, and by their Noble President, he would not detain them by more than a few words. He expressed his concurrence in the principles embodied in the remarks of the preceding speaker, observing, however, that if the application of those principles were in any way to be understood as implying a condemnation of institutions which did not include all the objects of Young Men's Christian Institutes—as Philosophical Societies, Mechanics' Institutions, or Schools of Art—then he should be under the necessity of differing from him, but his rev. friend had so guarded what he had said, and so distinctly expressed his high sense of the value of true philosophy, art, and letters, that he did not feel it necessary to say more than that he had for many years supported such Institutions, believing that they were the safeguards of the virtues of the young men belonging to them—and were antagonistic to all that was opposed to virtue and religion, and that though they did not directly promote the teaching of religion, they did indirectly accomplish that object. He need hardly say that in the combination of sacred and secular knowledge, young men would find their greatest happiness and safety.

Mr. Shipton, of London, gave his cordial support to the resolution.

Mr. Spence read a letter from Mr. Beecroft, M.P., apologising for his absence, and expressing his warmest congratulations on the distinguished success achieved by the candidates from the Institution at the examination of the Society of Arts. Letters of apology were also read from the Rev. J. D. Brocklehurst and Mr. C. Wentworth Dilke, Vice-President of the Society of Arts.

The Earl of Shaftesbury, after distributing the prizes, rose to address the meeting. He thought the Christian Association was now so well-established in the public mind, and so widely diffused, that it could require from him no explanation of its purpose, no statement of the service it had rendered, and no appeal to their sympathies for its enlarged support. His lordship adverted to the vast number of young men attracted to London and other large centres of population to assist in carrying on the commerce of the country, and to the difficulties and temptations to which they would be subject when absent from parental influence and domestic control if there were not Christian institutions to which they could resort, where they might repair the mischiefs of the day, and also find consolation and instruction. Referring to the distribution of prizes, his lordship observed that the introduction of prizes was a modification of the original principles upon which the Institute was founded. He was by no means prepared to condemn this, or to say that it could not be turned to a very good and efficient account, but still it was a matter for consideration, because novelties of this description were sometimes received with open hands, and people embraced them as likely to be productive of good; but unless they were duly and carefully watched, they might work a considerable change in the constitution of such a society before they were aware of it. The Committee of the Leeds Institution, however, must be by far the best judges of what were the peculiar necessities of the town, and the character of the persons to whom these prizes were given. It was not for them to close the library or stop the career of the sciences, but it was their duty to place young men in the right channel, to point out to them that, in human existence, though to all it might be given to rise, all could not rise, and many must be content with the simple attainment of knowledge. In conclusion, he reminded them that the Christian life was a life of action, and that the whole duty of man was to fear God and keep His commandments.

Sir Thos. Phillips moved the next resolution :—

"That this meeting hails with delight the success attendant upon the evening classes of the Institution, and acknowledges with the greatest pleasure and satisfaction the healthy stimulus given to the cause of education by the Society of Arts scheme of education."

He expressed his conviction that there was no danger that secular education would lead to infidelity in opinion or ungodliness in practice, and then explained at some length the special object of the Society of Arts scheme of examination. He concluded by referring to the formation of an Astronomical Society in connection with the Young Men's Christian Institute; and after remarking that they had purchased an excellent telescope, he appealed to the inhabitants of Leeds to support and relieve them from any pecuniary embarrassment which might attend their purchase.

Mr. Harry Chester seconded the motion.

The Rev. W. Guest moved a vote of thanks to the deputation from the Society of Arts, who had come down specially to attend that meeting.

The motion having been seconded, was carried unanimously.

The Mayor then took the chair, and

Mr. Baines moved a vote of thanks to the Earl of Shaftesbury for his kindness in presiding on that occasion.

Mr. W. Osburn cordially seconded the motion.

The Mayor, in putting the resolution, personally expressed his thanks to the noble lord, after which the motion was carried by acclamation.

The Earl of Shaftesbury responded, and the proceedings terminated at half-past ten o'clock.

During the evening Mr. W. Spark performed a selection of music on the organ.

LOCAL BOARDS AT LEEDS.

On Tuesday morning, at ten o'clock, a meeting of the Local Boards connected with the Young Men's Christian Institute, Mechanics' Institution, Yorkshire Union of Mechanics' Institutes, Holbeck Church Institute, and the Leeds Church Institute, was held at the Rooms of the Young Men's Christian Institute, Sir Thomas Phillips, Chairman of the Council of the Society of Arts, in the chair. Present :—Mr. Harry Chester, Vice-President of the Society of Arts; Rev. J. H. F. Kendall, Vicar of Holbeck; Rev. J. Blomefield, Incumbent of St. George's; Mr. W. Osburn, F.R.S.L.; Messrs. C. S. Spence, J. Pickering, B. Blake, J. Hole, J. Hamer, J. H. Hall. The object of the meeting was to endeavour to unite the several Boards into one body. Sir Thomas Phillips and Mr. Harry Chester, on the part of the Society of Arts, pointed out the importance of the several Boards uniting, and offered suggestions as to the constitution, object, and functions of the proposed Board; and resolutions were adopted recommending the various Institutions to unite together for the purpose of forming one Board. Another meeting is to be held in the Rooms of the Philosophical Society, when it is expected that the arrangements will be fully completed.

ON THE ACTION OF HARD WATERS UPON LEAD.

By W. Lauder Lindsay, M.D., F.L.S.

(*Concluded from page* 725.)

A friend in London has furnished me with the particulars of the erosion of a new cistern in his new house at Brompton; and similar cases are common in London. The cistern was roofed with wood; no rain-water entered it; the water supplied to the house was Thames water, from the Chelsea water-works,—a water which he describes to be regarded by laundresses as a soft water, compared with London pump or well water. This water, however, contains nearly 20 grains per gallon of solid matter, $16\frac{1}{2}$ grains consisting of carbonate of lime, and 3 of sulphate of lime and chloride of sodium; while oxide of iron, silica, magnesia, and carbonaceous matter exist only in minute proportions. There soon appeared, and there continued to be, a copious white sediment on the bottom of the cistern. He made a practice of cleaning out the cistern once a-year; and in about five or six years he found the lead fast becoming eroded over the spots most copiously covered by the white deposit. The remedy he resorted to was plugging the erosions or leakages with gutta percha.

The case related by Dr. Wall, of Worcester[*], and quoted by Dr. Christison,[†] is worthy of record here. A family, consisting of parents and 21 children, were constantly liable to stomach and bowel complaints; 8 children and both parents died in consequence. The house was sold after their death, and the purchaser found it necessary to repair the pump, the cylinder and cistern of which were riddled with holes, and as thin as a sieve. The plumber employed informed Dr. Wall that he had repaired it several times previously. Unfortunately, no analysis was made of the water, and we are left to infer that it was hard, from the fact that most of the water about Worcester is hard. This, however, does the reverse of account for its action on lead: hence the cause in this case was supposed to be one of the three following:—1. An unusually small proportion of salts; 2, An excess of carbonic acid; or 3, "Which is perhaps fully more probable, the corrosion was the effect of some obscure galvanic action!" Now it is doubtless very convenient to ascribe or attribute cases, otherwise inexplicable, to "obscure galvanic action;" but it is just to the rationale of this, and similar obscure actions of water on lead, that I am desirous of directing the attention of chemists. Many cases similar to that given by Dr. Wall are on record; but they are comparatively valueless, from the want of an analysis of the waters concerned. It is extremely desirable that in all future records of cases, there should be given some key to the character of the water. If nothing further can be stated or ascertained regarding it, the narrator would do service by mentioning whether it is hard or soft—whether it curdles soap, or forms a lather therewith. Dr. Christison says,—"Of spring waters, which act with inconvenient or dangerous rapidity on lead, several instances might be quoted. But it is hardly worth while mentioning more than one or two by way of illustration: because the nature of the water has been very seldom described so carefully as to supply the means of explaining their operation."[‡]

It may be asked, in the case of cisterns so eroded, and which must continue to contain the same kind of water, how is the tendency to erosion to be obviated? In the cisterns mentioned at p. 10, it was obviated, after repeated solderings and patchings, by coating the lead with a composition of rosin and tallow, which has answered the desired purpose admirably. This is the common mode of rectifying the mishap in this quarter (Perth). Plumbers, then, use a very suitable mechanical means of protecting the lead; but a very ingenious chemical means has also been recommended by several distinguished authorities. It has been found that different neutral salts protect lead from the corrosive action of water with different degrees of efficiency—chloride of sodium in the proportion of $\frac{1}{2000}$th, and sulphate of lime in that of $\frac{1}{4000}$th. Of these, one of the most powerful is phosphate of soda, a small quantity of which added to a water, prevents its action on lead. Hence it has been recommended to add to a water which is, or is supposed to be, corrosive of lead, a given proportion of this salt (about $\frac{1}{25000}$th part). Professor Christison has pointed out that this so-called "preservative powder" depends on, or resides in, the acid, and not the base, of the salt. For instance, the sulphates of soda, magnesia, and lime, as well as the triple sulphate of alumina and potash, preserve, as nearly as can be determined, in the same proportion. In regard to their relative preserving power, it is found that salts, whose acids form with lead a soluble salt, are least energetic, and *vice versa*.[*] Other mechanical means might be suggested to remedy the evil complained of,—such as the substitution of cisterns of other metals, or of wood, earthenware, glass, or gutta-percha. Or the lead may be lined with gutta-percha, india-rubber, or other materials. But my object at present is merely to indicate fully the evil, not to suggest a remedy.[†] For an illustration of the deleterious effects on the human system of hard water contaminated with lead, I am indebted to the kindness of a lady in Derbyshire, in whose household the following incident occurred.[*]

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[*] Transactions of London College of Physicians, ii. 400.

[†] Treatise on Poisons, 1835, p. 488.

[‡] Treatise on Poisons, 1835, p. 488.

[*] Treatise on Poisons, 1835.

[†] From communications received in relation to the above paper, as it was laid before the late meeting of the British Association, I find that my ideas regarding the coating of the interior of lead pipes and cisterns with substances on which water exerts no action, or at least, no deleterious action, have been anticipated by the patents of Mr. E. K. Davis, of 42, Tenison-street, York-road, Lambeth, London. The lead he manufactures and lines he guarantees to resist the action of waters of all sorts, as well as of beer and similar fluids; and his patents extend to England, France, and Austria. The essential principle of his patents is simply the lining or coating of the lead with substances not acted upon by water, beer, or other fluids, and which cannot, therefore, confer upon such fluids poisonous or deleterious properties. The materials he uses are various, specimens of which I have had an opportunity of examining for myself through the kindness of the patentee. I have accordingly every confidence in recommending Mr. Davis's patents to the notice of all who are charged with, or concerned in, the conveyance or storing up of water, beer, &c., for culinary or drinking purpose. The materials Mr. Davis uses are chiefly of two classes, viz.:—1. Pure tin. A special machinery is applied; the lead pipe or sheet is operated on in a solid state, but at a heat above the melting-point of tin. The fused tin and lead are firmly united, it being easy to make the coating of any desired or desirable thickness. If the coating be comparatively thick, then there is virtually a double cylinder or tube,—the outer or thicker being of lead the thinner and inner of tin. It is perhaps necessary to explain here that such pipes are quite different from what are known to plumbers as "tin-coated pipes." In the latter case, the coating is very thin, and consists of what is termed "fusible metal,"—a mixture of lead, bismuth, and tin. 2. Compositions of various gums, resins, gutta-percha, caoutchouc, bitumen, and similar materials, selecting such only as form an adhesive and flexible film, which will not be ruptured or abraded by the processes of bending and otherwise manipulating the lead. The specimens of pipes I have examined are first coated internally with a composition of several of the materials just named, and subsequently lined by a film of gutta-percha. Gutta-percha or caoutchouc cannot be directly applied as coatings, from their non-adhesiveness to metal when precipitated from their solutions But they adhere firmly to a surface of any of the compositions prepared by Mr. Davis. In reference to Mr. Davis's patents, the *Builder* remarks:—"The most hopeful and efficient remedy, however, now practically available, appears to be that provided under a patent secured by Mr. E. K. Davis, of Lambeth, for the coating (amongst other processes) of the interior of leaden water-pipes with a thin film, or inner tube of tin, or of compositions of gum-lacs and india-rubber or gutta-percha, in a soft or fluid state, by means of improvements in the usual

"Mr. B——, the gentleman who acted as tutor to our children last year, came to us soon after Christmas. He had previously been in perfect health, so far as regarded the digestive organs, although the localities in which he had been residing—Edinburgh during the college session, and Glasgow as his home—did not offer any peculiar advantages in this respect. Soon after his arrival he complained of dyspepsia in no ordinary degree. The usual remedies had no effect. A strict system of diet proved equally inefficacious. After exhausting the skill of our country practitioners, he went to Manchester to seek for relief there. Mr. —— a surgeon of large practice there, after a careful investigation of his mode of life, his symptoms, &c., told him that he could not account for the attack except on the supposition of lead being held in solution by the water. Mr. B—— objected that he was the only invalid in a family of nineteen, and that he believed the water was from a spring, and conveyed to the house by iron pipes. Mr. S—— rejoined that the conditions of his ordinary life were so favourable to health, the hours of the meals so appropriate, and the remedies which had been used so fitted to benefit a case of pure indigestion, had there been no irritating cause, continued that the presence of lead in the water offered the only solution of the difficulty. On his return, we drew four bottles of water from four different taps within the house, and sent them to Professor —— for investigation.

"The origin of the water with which we are supplied is rather singular. Far up on a high hill two springs, within ten or twelve feet of each other, rise, and mingle their water a few yards lower down. One of them is excessively hard; the other is equally soft. Both flow together into a reservoir; thence filtering through gravel, they pass into iron pipes, which, descending into a deep valley, and crossing it, rise again to the hill on which our house is situated. It is carried up to the very top of the building, and is there deposited in a lead cistern, from which some leaden pipes lead it down to the butler's pantry and the place from which we used to get our drinking water. The kitchens, &c., were supplied from the iron pipes before the water ascended to the top of the house. The house is very large, and the roof is flat. The cistern occupies a large space on the top, and is, of course, exposed in its full extent to the air.

"Professor —— detected lead in the two taps leading from the cistern; the other two he declared to be perfectly free from it. The bottles were simply labelled with initial letters. We were very incredulous, and, on expressing our disbelief, he asked us to send the water again differently labelled. The result was the same as before. We immediately removed the filter to one of the kitchen pipes (the water from) which had been declared to be free from lead. In a short time Mr. B. was decidedly better: he looked very much better, his colour clearer, and his whole appearance improved; but he said he still felt occasionally some touches of his old complaint, although nothing in comparison to what he formerly endured. He has gone to Glasgow for the holidays, and wrote to me the other day that 'he ignores the very name of indigestion.'"

In a subsequent letter,[*] explanatory of some details the same lady informs me:—"We consider the water hard, although, as I mentioned before, there is a soft spring mingled with the hard one. . . . . Lead was found in this hard water after it had been conveyed into a leaden cistern and distributed thence in leaden pipes through part of the house. No trace of lead was found in the same water, which was also in the house, but flowed through iron pipes only."

According to the analysis of Professor ——, the water drawn before it entered leaden pipes or cisterns contained of

Organic matter, per gallon	3·50 grs.
Inorganic ,, ...	11·37
	14·87

The latter consisted of the following salts:—

1. Potash.—*a.* Chloride—very small quantity.
   b. Sulphate—a trace.
2. Lime.—*a.* Sulphate—rather abundant.
   b. Carbonate—small quantity.
3. Magnesia.—*a.* Chloride—rather abundant.
   b. Sulphate—small quantity.
   c. Carbonate—small quantity.
4. Iron.—*a.* Carbonate—very small quantity.
5. Ammonia.—*a.* Nitrate—a trace.[†]

The analyst designates the water "very soft," and reports it as fit for all domestic purposes, in the absence of lead; while Mrs. B., in her letters above quoted, repeatedly speaks of it as hard! It is now well-known that the quality of hardness in water does not depend merely on the amount of its saline ingredients, but chiefly on their kind or nature. Professor Graham points out that some London waters are soft, though containing as much as $\frac{1}{1240}$th of solid matter.[‡]

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machinery for making leaden pipes themselves. The coating appears (in pieces of the various tubes which we have purposely examined) to be perfectly adherent, of quite sufficient thickness, and otherwise efficient in its formation for the purpose in view." "The mechanism by means of which these and other processes are effected is ingenious; and the patent of Mr. Davis comprehends various improvements,—such as a double-action hydraulic press, the casing of soft metal pipes with block-tin and other metals, the forcing of soft metals by compressed air, the plating of sheets in a way described, the making of dies for coating lead and other pipes with other metals, a mode of making still-worms, the coating of soft metal pipes with gutta-percha, india-rubber, &c., and various other improvements. It is with special reference to a remedy for the contamination of water by lead that we have examined the pipes coated under this patent; and we think it well deserves the public patronage, as tending towards the realisation of that very desirable end." The London plumbers, who are familiar with the fact that new cisterns in London houses are frequently eroded to the extent of leakage in the course of one or two years, usually apply as a remedy a coating composed of rosin, white lead, and grease! This, it need hardly be observed, is a most objectionable remedy compared with the substances enumerated in Mr. Davis's patents. Dissolved india-rubber has, however, been applied to a similar purpose; and it has been suggested to me by an ingenious correspondent that a varnish of coal-tar, which dries hard and fast, and is deemed a most serviceable coating for exposed iron and other metallic work, might also be used.

[*] Narrative contained in letter dated 14th July, 1858.

[*] Of date 2nd August, 1858.

[†] Date of analysis, October 10, 1857.

[‡] At my request, two beer bottles full of the waters in question,—the one specimen (No. 1) drawn from lead pipes passing through a lead cistern containing the water, and the other (No. 2) taken from iron pipes, the water not having in this case been at all contained in, and not having passed through, leaden vessels, were kindly sent to me for analysis in the beginning of August last; but I was unable to overtake their examination till the 20th of September. My results were as follows:—No. 1 had, on drawing the cork, a distinct smell of sulphuretted hydrogen; and the water contained a quantity of brown flocculent matter, apparently derived from the cork. A stream of sulphuretted hydrogen was passed through the water, both in its original state, as received, and after it had been greatly concentrated by evaporation. Not a trace of lead was discovered by this or any other process applied; neither was iron detected by the rough qualitative methods employed. There was a small proportion of sediment on evaporation. Carbonates were comparatively abundant; chlorides and sulphates in very small quantity; lime and magnesia were plentiful, the former especially.—No. 2 also had a slight smell of sulphuretted hydrogen. The water gave precisely the same reactions as No. 1, except that the sulphates and carbonates were rather more abundant.

I was recently informed by a friend in London, who formerly lived in Brompton, that he constantly or repeatedly suffered from anomalous stomach complaints while he resided there, and which he attributed solely to the water with which his house was supplied being contaminated with lead; of this, however, he had no chemical proof. The water he described as hard: it was supplied by one of the London water companies,—the water furnished by all of which contains, in comparison with the waters of Edinburgh and Aberbeen, large quantities of solid or saline constituents. He only got rid of his symptoms by removal to Clapham, where the water supply is derived from a garden-well, sunk in the gravel of the London basin. This water also is described as hard; but it is not contained in leaden cisterns, nor does it pass through leaden pipes. This same gentleman, who is connected with the Metropolitan Board of Works in London, and who has an ample experience of such matters, informs me that such cases are very common in London, —so common, indeed, that he laughed at the idea of hard waters protecting lead.

I will now briefly review the various theories or explanations that have been, or that may be, advanced to account for the action of spring waters, which are generally more or less hard, upon lead. They may be tabulated as follows:—

1. Unusually small quantity of
    - *a*. The neutral salts generally, or in the aggregate.
    - *b*. Particular neutral salts, such as the carbonates and sulphates.
2. Unusually large proportion of carbonic acid in the water.
3. The presence of acids derivable from decaying vegetable or animal matter.
4. Presence of foreign bodies or accidental impurities.
5. Presence of nitrite of ammonia.
6. Presence of atmospheric air in the water, perhaps in unusual amount.
7. Use of leaden covers to cisterns.
8. Long exposure of still water to the same surface of metal.
9. Great extent of surface exposed.
10. Galvanic action from the contact of different metals, or of different qualities of the same metal, under water.
11. Chemical or electro-chemical causes, with which we are at present unacquainted.

With a knowledge of the statements of Professor Christison as to the power of the neutral salts generally to protect lead from the corrosive action of water, it is unnecessary to illustrate the first half of the first proposition or cause above tabulated, because a water deficient in such salts approaches the characters of rain or distilled water. And further, with a knowledge of what has been determined in regard to the different protective powers of particular neutral salts, it is easy to comprehend how a water containing abundance of chlorides, but a minimum of sulphates and carbonates, should act upon lead nearly as readily and rapidly as if there were an absolute deficiency of all neutral salts.

Professor Daniell says that all waters will corode lead if they contain excess of carbonic acid. "My friend, Professor Daniell," says Dr. Pereira, "informs me that he has found lead in the well-water obtained at Norwood. The water is very hard (that is, holds a large quantity of sulphate of lime in solution), and contains much free carbonic acid. It is the latter ingredient apparently which holds the lead in solution; for, by boiling, the whole of the lead is precipitated. The water is raised from the well by a leaden pump, to which is (?) attached a few feet of leaden pipe. Professor Daniell's attention was directed to the subject in consequence of the occurrence of several cases of lead colic in the neighbourhood of his residence at Norwood."* Professor Taylor opposes the statement, that carbonate of lead is at all soluble in water charged with carbonic acid. "It has been supposed," says he, "that carbonic acid contained in water would partially dissolve and suspend the carbonate in it; but in saturating water with carbonic acid, over finely-divided carbonate of lead, it was not found, on filtration, that any perceptible portion had been dissolved."† "Natural water," says Professor Fownes, "highly-charged with carbonic acid, cannot, under any circumstances, be kept in lead or passed through lead pipes with safety; the carbonate, though very insoluble in pure water, being slightly soluble in water containing carbonic acid."‡

It has been supposed, and with every prospect of the supposition being correct, that the presence of decaying leaves and similar organic matters, whether of vegetable or animal origin, may favour the corrosion of lead by the development of various acids due to the gradual decomposition of such organic matters. Pereira mentions a case in which a fragment of mortar appears to have aided or determined the corrosive action of the water.

"The presence of nitrite of ammonia in water," says Dr. Medlock, "I have clearly established by the most conclusive experiments; and it is to the presence of this substance, both in distilled waters and waters selected for domestic use, that the action of such waters on lead is due. The nitrous acid attacks the lead and forms the soluble nitrite of lead, which, by exposure to air, combines with carbonic acid, and precipitates the oxide of lead in the form of insoluble carbonate of lead, setting free the nitrous acid again to attack and dissolve a fresh portion of lead."§

It has been suggested that the presence of an unusual amount of atmospheric air in water would favour or facilitate its action on lead. Doubtless it would do so were it proved to exist, but this cannot be an important element or agent in the action in many cases. The presence of air externally to the water is as much an essential to the action as is that of the water itself; for, unless there is free exposure to the air, oxidation and the subsequent changes in the metal will not proceed. Water is well-known to be capable of holding in solution a considerable proportion of air and other gases. Rain-water, remarks Professor Christison, generally contains 2½ per cent. of its bulk of air, in which the proportion of oxygen gas is so high as 32 per cent. In water from freshly-melted snow the proportion of oxygen is 32·8 per cent., according to the observations of Gay-Lussac and Humboldt, while the oxygen in atmospheric air does not exceed 21 per cent.‖ Professor Christison has also pointed out that distilled water deprived of its gases by ebullition, and excluded from contact with the air, has no action on lead.¶

It will be observed that there is some discrepancy between the analysis originally made by an English chemist and my own results as just given. This is not to be wondered at, when we consider the changes in the composition of waters produced by season, rainfall, drought, &c. A fall of rain, for instance, must greatly modify the composition of waters, especially if they are derived from the surface drainage of an agricultural district. The tables furnished by Dr. R. D. Thomson, of St. Thomas's Hospital, London, and published in the reports of the Registrar-General of births, deaths, &c., show distinctly the difference in the composition, from month to month, of the same waters, supplied by the same metropolitan water companies, and derived from the same sources. Dr. Medlock remarks,—"It not unfrequently happens that a water which, at one season of the year, acts vigorously upon lead, has no action upon it at other seasons." *(Ol. citat. p. 33.)*

* A Treatise on Food and Diet. By Jonathan Pereira, M.D., &c. P. 96. London, 1843. See also Morson, in Pharmaceutical Journal, November 1, 1842.

† On Poisons. London, 1848. P. 450. "Water Poisoned by Lead."

‡ Manual of Elementary Chemistry. London, 1856. P. 333.

§ On the Action of Certain Waters upon Lead. Record of Pharmacy and Therapeutics, Part II. London, 1857. P. 34.

‖ Trans. Roy. Soc. Edin., Vol. 15, Part II., p. 271.

¶ Treatise on Poisons, 1835, p. 476.

The use of leaden covers to cisterns is fraught with great danger, and fortunately is comparatively seldom resorted to by plumbers. If cisterns are covered at all, probably the safest material is wood. However impure or hard a water is, however saturated with sulphates and carbonates, and however free from plumbeous impregnation, the moisture which results from its evaporation, and which condenses on the lead cover, is pure or distilled water. Hydrated oxide and carbonate are produced in the ordinary way; these gradually encrust the lead, and by-and-by scales or fragments fall off and drop into the subnatant water, in which they are partly dissolved, partly held in a state of suspension.

Time is a most important element or condition in the action of water on lead. The mere flowing of water through leaden pipes, and the standing of water for a long period in leaden cisterns, are two very opposite conditions. Accordingly, it is found that the same water which will cause no perceptible change on lead from short contact, will produce a copious deposit of oxide and carbonate on standing for some weeks or months. Professor Christison remarks this in regard to Edinburgh water, which contracts no material impregnation after a few days' contact. A cistern in his laboratory in the University of Edinburgh was left undisturbed for five or six months with a few inches of water in it. After the lapse of this period, he found "so large a quantity of pearly crystals lying loose on the cistern, and diffused through the water, that, when the whole was shaken up and transferred to a glass vessel, the water appeared quite opaque."[*] I believe that such is the action of Edinburgh water,—a water containing about 12 grains per gallon of solid matter,[†] that in the course of ten days or a fortnight, while at rest in contact with lead, it will dissolve the metal to the extent of about $\frac{1}{500}$th of a grain at least per gallon. Professor Christison again remarks, —"Neither ought ordinary terrestrial waters to be kept very long in leaden vessels; because the same changes, though not appreciable in a few days or weeks, are nevertheless accomplished in the course of time."[‡] The late Dr. Thomson, of Glasgow, says, when he lived in Edinburgh, he "could always detect a minute trace of lead suspended in the water, which at that time was brought six miles in leaden pipes."[§]

An equally important element in the action is perhaps the extent of surface exposed. It not unfrequently happens that experiments on the small scale give erroneous, and consequently dangerous, results, merely because the surface exposed was too small and the time allowed too short. Professor Christison gives an apt illustration. A gentleman in Dumfriesshire had resolved to introduce into his house, through leaden pipes, the water of a spring some three-quarters of a mile distant. But, with a view to ascertain whether it was quite safe to do so, the usual experiment was made, of placing a few freshly-scraped or polished leaden rods in contact with the water for a few days. At the end of a fortnight, the result was imperceptible; from which it was forthwith concluded that this water might be conveyed through lead pipes and stand in lead cisterns with all safety.[||] The works were immediately carried out; but the results were as dangerous as they were unexpected. The water was soon found to be impregnated with lead to such a degree as to be opalescent. Analysis showed the water to have been extremely pure, containing not more than $\frac{1}{22000}$ of saline matters, which consisted mainly of sulphates, chlorides, and carbonates. Here the unintentional experiment with 784 square feet of lead produced very opposite results from that with a few inches![*]

Galvanic action in connection with the corrosion of lead seems to me to be a most hopeful field of research. It is generally called into requisition to explain all anomalous cases of the action of hard waters on lead. But this is making too much of it. I have no doubt that it exerts a powerful influence in many cases, but it has yet to be distinctly shown in what cases, how and under what circumstances, it operates. The subject is by no means new. Dr. Paris long ago drew attention to it, and it has also been taken up by Professors Christison and Pereira; but it is still, to say the least of it, very imperfectly understood. I would therefore strongly recommend it to the study of chemists and electricians. The contact of other metals with lead, the use of solder, the mere existence of impurities or inequalities in the lead, seem to determine galvanic action; in which event the lead "becomes more susceptible of, and exposed to, the agency of electro-positive elements, among which are alkalis and alkaline earths, and these exert considerable solvent power over it."[†] "Galvanism," says Professor Christison, "is a most co-operating agent, or rather, perhaps, it should be considered a distinct power, for it acts with energy where water alone acts least,—viz., where there is saline mater in solution, because then a galvanic current of greater force is excited. . . . Even inequalities in the composition of the lead may have the same effect. Sheet-lead, long exposed to air or water, is sometimes corroded in particular spots; and these will always be found in the neighbourhood of parts of the metal differing in colour, hardness or texture, from the general mass. This, however, is a mere supposition; but it affords ready explanation of the corrosion. Similar effects may arise simply from fragments of other metals lying long in contact with lead. . . . I have no doubt that many of the instances of unusually rapid corrosion of lead by water,—such as that mentioned by Dr. Wall, are really owing not to the simple action of water, but to galvanic action, excited obscurely in one or other of the ways now mentioned."[‡]

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[*] Treatise on Poisons, 3d edit. 1835, p. 491.

[†] As a comparative statement, I may here mention that, in round numbers, the water of Glasgow,—supplied from Loch Katrine,—contains from 1 to 2 grains per gallon of solid matter; that of Aberdeen 2 to 4; and that of London from 15 to 30!

[‡] Dispensatory, 2d edit. 1848. Art. *Plumbum.*

[§] Christison's Treatise on Poisons, 1835, p. 487.

[||] "Water, which tarnishes polished lead when left at rest upon it in a glass vessel for a few hours cannot be safely transmitted through lead pipes without certain precautions. Conversely—it is probable, though not yet proved, that if polished lead remain untarnished, or nearly so, for twenty-four hours in a glass of water, the water may be safely conducted through lead pipes."[a] Taylor, too, regards the freshly-scraped piece of lead as a good test of the absolute purity of distilled water; and conversely, of the liability of water to poisonous impregnation with lead. If the fresh metallic surface, says he, remain bright after some days, or only acquire a faint incrustation of sulphate, and if sulphuretted hydrogen does not give a brown tint to the water there is but little danger of its becoming poisoned with lead.[a]

[a] Christison, Trans. Roy. Soc. Edinb., vol. xviii., part ii., p. 271.

[a] On Poisons, London, 1848, p. 450—"Water poisoned by lead."

[*] Treatise on Poisons. 3d edit. 1835, p. 489.

[†] Pereira on Food and Diet, p. 97, and Brande's Dict. of Mat. Med. and Pract. Pharmacy, p. 80. London, 1839.

[‡] Treatise on Poisons, pp. 494-5.

In the discussion following the reading of this paper at the British Association, several interesting illustrations were given of corrosive action on lead and copper, attributable or supposed to be attributable, to galvanic action. For instance (I quote from a Leeds newspaper), "a member said that when copper sheets from different factories were joined together to cover the bottoms of ships, strong galvanic action was set up when they were immersed in sea-water. When all the sheets on the bottom of the ship were of the same kind of copper, the corrosion was very slight. As lead was affected in a similar manner, the sheets of that metal used for lining cisterns ought always to be of one kind." Dr. Edwards attributed the different action of the same water on different lead cisterns to the fact that some sheets of that metal were made from old lead, containing an admixture of solder, which caused it to be corroded by galvanic action. It was shown that thirty or forty years ago, cisterns were not so much acted on

In the course of a lecture on "Public Health," delivered in the City Hall, Perth, on the 4th January last, Dr. Stirling, of Perth, made the following statement in regard to the influence of galvanic agency in determining the corrosive action of various waters, containing saline matters, on lead:—"Having compared the effect produced on lead rods immersed in solutions of various neutral salts, in distilled water, with that produced on similar rods in contact with copper wire, immersed in solutions of the same salts, and of the same strength, I am led to the following conclusions, viz.—1. That galvanic action is a most powerful agent in promoting the corrosive action of certain waters upon lead; 2. That, in water containing a small proportion of certain feebly protective salts, galvanic action is slightly, if at all produced; 3. That, in water containing the same salts in so large quantity as to be considered protective to the metal, galvanic action is so powerfully induced as to render the water, instead of innocuous, nearly as corrosive as the very weak solution; 4. That, in water containing certain powerfully protective salts, galvanic action is sufficiently produced to render it doubtful whether any saline solution can altogether protect lead from corrosive action, when, from the nature of the containing vessel, or other cause, galvanic currents may be induced."

Lastly, there are perchance other chemical or electro-chemical causes, whose action is presently unknown or imperfectly understood. These I leave with confidence for investigation in the hands of the Chemical Section of the British Association; for on such causes or their action I am not prepared to throw any light.

I firmly believe that cases of lead poisoning on the small scale, or rather, I should say, in a minor degree, are constantly occurring in all our large towns, from the plumbeous impregnation of drinking-waters. The medical man is often extremely puzzled to account for certain anomalous symptoms in his patients; and he puzzles himself in vain, until he at last bethinks himself of the assistance of the chemist, who discovers lead in the drinking-water used. Attacks of lead colic—isolated or endemic—are frequently the first circumstance to attract attention to the state of the water supply. On talking over the matter with medical men in London and elsewhere, I find the suspicion strong, though they are seldom in a position to prove indubitably the correctness of their suspicion, that many obscure cases of colic and other intestinal affections, as well as of paralysis of the nature of lead palsy,—sometimes going on to a fatal issue,—are really due to plumbeous impregnation of drinking-waters; and under so many different circumstances do such cases occur, that in a large proportion at least, the water so impregnated must be hard in the sense in which I have used that term. In all cases of obscure colicky or paralytic complaints,—especially if it be found that several persons are simultaneously affected,—the condition of the water supply should be diligently inquired into, with a special view to the presence in it of lead. Dr. Robertson, of Manchester, remarks,—"What I would here advert to is the custom, so general in England, of using lead cisterns for storing water, especially where, as in many of our towns, the supply is intermittent. Such cistern water is always tainted with lead, not in quantity, it may be, to produce the distinguishing symptoms of lead poisoning, but enough to affect very injuriously the stomach and nervous system of persons habitually using it."*

For the benefit of those who may be desirous of following up the subject of the foregoing remarks, I beg to append, in a collected form, a few bibliographical notes:—

Professor Christison of Edinburgh:
  1. Treatise on Poisons. 3d edit. 1835. Edinburgh.
  2. Dispensatory. 2d edit. Edinburgh, 1848.
  3. Paper in Transactions of Royal Society of Edinburgh. Vol. XV., Part II., 1842.

Professor Pereira:
  1. A Treatise on Food and Diet. London, 1843.
  2. Elements of Materia Medica and Therapeutics, 3d edit. London, 1849.

Professor Taylor:
  1. On Poisons. London, 1848.
  2. Guy's Hospital Reports. No. VI., O.S.

Dr. Wall, of Worcester: Transactions of London College of Physicians. II. 400.

Dr. Scudamore: Analysis of the Water of Tunbridge Wells. 1816.

Dr. Thomson, of Glasgow, in Appendix to above. Also in Edinburgh Medical and Surgical Journal, Vol. XII.

Dr. Lambe of Warwick: Researches into the Properties of Spring Waters. 1803.

Dr. Yeats: Hints on a Mode of Procuring Soft Water at Tunbridge. Journal of Science, XIV. 352.

Vitruvius: De Architectura. L. VIII., c. 7. Quot modis ducantur aquæ. Ed. Dan. Barbari, 1567, pp. 262–5.

Galen: De Medic. secundum locos. LVII.

Wood and Bache: The Dispensatory of the United States of America. 3rd edit. Philadelphia, 1836.

Professor Graham: Elements of Chemistry. 1842: and Vol. II. London, 1858.

R. Phillips, in Report from the Select Committee of the House of Lords appointed to inquire into the Supply of Water to the Metropolis. 1840.

Dr. Bostock, in Report of the Commissioners appointed to inquire into the State of the Supply of Water in the Metropolis. 1828.

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Turner's Elements of Chemistry. By Liebig and Gregory. London, 1847.

Dr. Medlock: "On the Action of certain Waters upon Lead:" Record of Pharmacy and Therapeutics of General Apothecaries' Company, London. Part 2. 1857.

BRITISH ASSOCIATION, ABERDEEN, 1859.

The following papers were read in the Mechanical Section:—

On Smokeless Coal-Burning in Locomotive Engines.

By D. K. Clarke.

The substitution of coal, as fuel, for coke in locomotives, is not only felt to be a commercial necessity for the reduction of expenditure, but is also discovered to be perfectly practicable as a mechanical problem, in conformity with the conditions laid down in the Railway Acts of Parliament, that railway engines shall consume their own smoke. The means of doing so, to be acceptable to a

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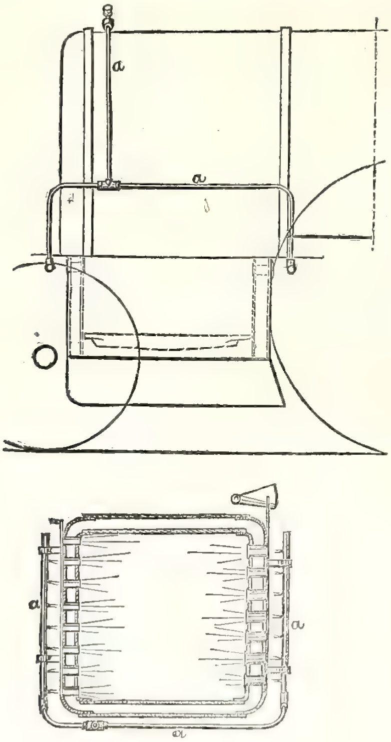
by water as now; and it was probable that this was owing to the fact, that the silver in lead was now extracted, whereas formerly it was not worth while to do so. The long corroded streaks which were often observed in sheet-lead were caused by galvanic action set up by small portions of tin which had been attached to old lead." "The Rev. W. V. Harcourt could not understand how the presence of silver in lead could affect it much, considering the electrical relations the two metals bore to each other. In his opinion, it was advisable to use leaden vessels for holding water as little as possible, for it was clear that health was in constant danger from it."

* A Few Additional Suggestions with a view to the Improvement of Hospitals. By Mr. John Brotherton. [Reprinted from the Transactions of the Manchester Statistical Society. Read March 31, 1858.]

locomotive engine, must be simple in design, facile of application to existing locomotive stock, easy to manage, easy to maintain, efficient in promoting the combustion of coal without smoke, keeping up the steam, and saving expense.

These desirable qualifications, the writer believes, belong to this system of smoke prevention. The whole apparatus is external to the fire-box, and therefore not exposed to heat, and it is controlled in the most perfect manner by a single stop-cock. Air is admitted above the fuel by one or more rows of tubes inserted through the walls of the fire-box, and jets of steam are projected through the air-tubes from nozzles one-sixteenth inch in diameter, in small steam-pipes placed outside the fire-box, to increase the quantity and force of the air admitted above the fuel, in order to consume the smoke. The jets of steam are used principally when the engine is standing, with the aid of a light draught from a ring jet in the chimney, to carry off the products of combustion, and they may be shut off when not required. The supply of air through the tubes may also be regulated by dampers. The grate bars are placed close together, with narrow air spaces, and the ash-pan and damper are tightly-fitted. The level of the fuel should at all times be below the air-tubes.



a a, Steam-pipe.

This system is working, with entire success, on the engines of the Great North of Scotland Railway, at Aberdeen. It is also successfully at work daily (amongst other lines) on several of the engines of the North London Railway, where, as a metropolitan line, the regulations against smoke-nuisance are rigidly enforced. It requires a less weight of coal than the engines formerly required of coke for the same duty, and thus saves the whole difference in cost of fuel.

The locomotive engine has been variously cut up, in order to suit the views of designers for the combustion of coal without smoke. In the plan before the meeting, the original type of engine promulgated by Mr. Stephenson, and at this day universally adopted, and unsurpassed, is preserved intact; and the locomotive is thus rendered a complete and perfect machine, and entirely meets the great railway necessity of the day—the perfect combustion of coal in railway engines.

Some of the members of the Committee, through the kindness of Mr. Cowan, the Locomotive Superintendent of the Great North of Scotland Railway, had an opportunity of witnessing Mr. Clarke's system in action. The result of the trip was very successful. The smoke was most effectually got rid of, and the apparatus was under such control that smoke was got rid of or produced, by simply opening or shutting the valves. Mr. Cowan stated that he had had the apparatus working for some time, and could testify, not only to its efficiency, but to the saving in fuel effected by its use.

Report of the Progress of Steam Navigation at Hull.

By James Oldham, M. Inst. C.E., Hull.

In continuation of my report on the progress of steam navigation, as connected with the port of Hull, I have to observe that, during the last two years, no very great change has taken place in the number of steamers, although I shall have to state some interesting facts occurring during that time. For generations past Hull has been noted for its Greenland and Davis Straits fishery, which for many years has constituted the chief feature of the port; and, at one time, upwards of sixty large ships were sent out, with crews varying from thirty to forty men each, and representing a capital for all that concerned the trade, of about £700,000 sterling. In 1818 Hull sent out to the fishery sixty-three ships, which brought home 5,817 tons of oil, and in 1820 sixty ships were sent out and returned home with 7,782 tons of oil, exclusive of whalebone. In this year (1820) the total number of ships at the fisheries, from England and Scotland, amounted to 156; and the entire weight of oil obtainedwas 18,725 tons, and of whalebone 902 tons. Owing, however, to the introduction of coal gas for the lighting of streets and buildings, and large importations of oils for manufacturing purposes from the Mediterranean and other places, together with the scarcity and difficulty of taking the whales, fish-oil became in a great measure superseded, and consequently the fishery nearly abandoned, and an enormous amount of property, once of so much value, almost entirely lost. Within the last two or three years steam has been put into successful requisition to aid the dauntless and hardy mariner in the pursuit of this hazardous calling, and now we have several screw steamships employed; and although some of them are fitted with comparatively small power, they have proved to be possessed of great advantage in the service, and in some instances satisfactorily to the owners. We have had two descriptions of steam-vessels employed in the fishery; the first the old wooden sailing ships, which had been engaged in the service for some years, but which were afterwards fitted with screw machinery an auxiliary steam power. The second, iron-built ordinary screw steam-vessels, but which proved, I believe, almost a total failure, the material of which they were built, and the want of strength for such a purpose, proving them altogether unfit to contend with the severity of the climate and rough encounters with the bergs and fields of ice; some becoming total wrecks, while others returned bruised and rent, and with difficulty kept from sinking. A question here arises how far iron ships are calculated to bear the severe frosts of high latitudes, and whether wooden-built vessels, with all their defects, are not the best adapted for encountering such a climate? The screw steam-ship which was first sent from Hull, or any other place, to the fishery as an experiment, was the *Diana*, timber-built, 355 tons, 40-horse power, high pressure, the property of Messrs. Brown, Atkinson, and Co., of Hull. The vessel had been some time engaged in the fishery as a sailing ship, but her spirited owners, thinking an important advantage could be gained, determined upon the adoption of steam power, and at once had the *Diana* fitted for the the spring of 1857, by Messrs. C. and M. Earle, who put in the engines and made the screw to lift out in case of need. The experiment fully answering their expectations, Messrs. Brown, Atkinson, and Co., bought the *Chase*, a fine American built ship, of immense strength, and of 558 tons. She was fitted by Messrs. Martin, Samuelson, and Co., with condensing engines of 80-horse power, and despatched to the fishery in the early part of 1858, and with good results. By the application of steam, ships in this service can now make a voyage first to Greenland, and afterwards to the Davis Straits. In the commencement of this year several ordinary iron screw steamers were despatched to Greenland, viz., the *Corkscrew*, *Gertrude*, *Emmeline*, and *Labuan;* the latter only of this class, which is the property of Messrs. Bailey and Leetham, had any success; but, in consequence of her great strength and peculiar form succeeded in a tolerable way; the others were much damaged, and, as I have already remarked, returned in bad condition. The *Labuan* is 584 tons burthen and 40-horse power.

The next point of interest connected with the steamships of the port of Hull refers to alterations made in some of the vessels. The *Emerald Isle*, a paddle timber ship of 1835, the property of Messrs. Gee and Co., originally 135$\frac{8}{10}$ long, lengthened 35 feet, with a gain of 14 inches draught of water, and increased capacity for 100 tons dead weight. The *Sultana*, iron screw steamship of 1855, the property of the same house, originally 150 feet long, lengthened 30 feet, with a gain of 10 inches draught of water, and an increased capacity of about 100 tons. It is interesting to observe that in both cases we have no diminution of speed through the water, and that both vessels are improved as sea boats. Daily experience teaches the advantage gained, in almost every point of view, by ships of great comparative length. The iron steam-ship *Lion*, of Hull, formerly a paddle-boat, 249 feet long, but now converted into a screw-steamer by her owners, Messrs. Brownlow, Lumsden, and Co., under the direction of Mr. Anderson, their engineer, exhibits the great advantage gained by the alteration. Her register tonnage is 690, and the total tonnage 1,014. She was formerly fitted with steeple engines of 350 horse power, and had four boilers, two before and two abaft the engines; but these were substituted for direct action engines of 150-horse power, and two of her old boilers replaced, and by this alteration a clear length of hold in midships of 23 feet is gained. She required before the conversion 650 tons of coal for a Petersburg voyage, and consumed 30 cwt. to 40 cwt. per hour; but now 350 tons for the voyage, and a consumption of 20 cwt. per hour. By the change of machinery, about 130 tons of dead weight is removed from the ship, and she is now able to carry 400 tons more cargo. Her speed is also improved considerably; before the alteration, when drawing on an average 14 feet, the rate was six knots and a-half, but since the change, when drawing even more water, they can steam eight knots. Thus a saving in almost all the departments of the ship and other advantages, have been effected in this important change. During the last two years many fine steamships have been built in Hull, and others are in process of building for English and foreign service, by Messrs. Brownlow, Lumsden, and Co., Messrs. C. and W. Earle, and Messrs. Martin, Samuelson, and Co. The last named firm are making rapid progress in the building of two large iron paddle ships for the Atlantic Royal Mail Steam Navigation Company, of the following dimensions, power, &c.:—

	Feet.
Length between the perpendiculars	360
Beam moulded	40
Depth	30
Tonnage, builder's measure	2,860
Nominal horse-power	800

These ships are to have three decks, and to be fitted fore and aft for passengers. Speed through the water, twenty miles per hour. They will be of immense strength, and their build and form such as to ensure their becoming fine sea boats. Since the meeting of the British Association, at Dublin, considerable advance has been made in London and other ports in the application of superheated steam, and, I believe, with great success and satisfaction in the results; Hull, however, is acting on the motto, *festina lente*, and before taking a decided step in this important discovery, is anxious to see and adopt the best mode of the application of the principle, being assured that in every onward movement it is better "to make no more haste than good speed." Some attention has been paid to the consumption of smoke in the furnaces of our steam vessels, and with a considerable amount of success. I may here mention the mode of Mr. Ralph Peacock, of New Holland, Hull, for which he has taken out a patent. It consists of a double furnace-door, the chamber or space between the inner and outer surfaces being five to six inches in width. The inner plate is perforated very full of small holes, and in the outer plate a revolving ventilator is inserted, which is on the principle of that invented by Dr. Hale, to supply close places with fresh air. The apparatus is in use on board the *Helen Macgregor*, one of Messrs. Gee and Co's. large sea-going steam-ships, and has given very general satisfaction; for by the report of the chief-engineer, Mr. McAndrew, a saving of fuel is effected and the steam better sustained. Another great advantage, as reported by the master, Captain Knowles, derived from this invention, is, that on running before the wind, they are never now annoyed and endangered by a dense cloud of smoke in the direction of the ship's course, which, particularly at night time, creates so much risk of collision. This apparatus is also in use on board several other steamers, viz., the *Yarborough* and *Grimshaw*, belonging to the Anglo-French Company, the *Albert*, of Hull, and also a number of river steam-boats. I have great pleasure in noticing also an improvement introduced on board the *Queen of Scotland*, another ship belonging to Messrs. Gee and Co., for the same object, by the chief-engineer, Mr. Smith, and having furnaces of ample capacity, it answers the purpose in a most satisfactory manner. Mr. Smith's mode consists simply in keeping a few inches of the front ends of the bars quite clear and clean from side to side of each furnace, thus admitting at the right place a sufficient amount of air. The report of the master, Captain Foster, is very satisfactory; I have witnessed also the effect of this mode on furnaces of stationary boilers with perfect results. I have now to refer to the application of Silver's marine governor, as applied by Mr. John Hamilton, of Glasgow. Several of these ingenious and efficient instruments are now in use on board steam-ships in the port of Hull, giving the highest satisfaction. There are so sensitive in their action, that the slightest pitching motion is at once indicated, and the steam admitted or excluded as the case may be. By the use of this governor, the full power of the engines is in immediate and constant requisition, producing the effect of saving of time, saving of fuel, and preventing of accidents by what is termed racing and otherwise. The ordinary mode, in the absence of the governor, is for the engineer in stormy weather and heavy seas continually to stand at the throttle-valves, or, to save himself this trouble, to throttle the engines, and thereby, when the full power of the engines is most required, it is frequently reduced to one-half or less, and consequently there is occasioned a loss of time on the voyage, and the risk of falling on to a lee shore.

The following is a brief statement of the tonnage, &c., of steam-vessels belonging to or trading from the port of Hull at the present time. 1st. Sea-going steamers belonging to the port, 22,290 tons register; horse power, 5,824. 2nd. River-steamers belonging to the port, 1,050 tons register; horse power, 450. 3rd. Sea-going steamers trading to Hull, but belonging to other ports—and although many changes have taken place—remain much the same as shown in my last report, viz., about 21,200 tons register; horse power, 5,300. 4th. River-steamers trading to Hull, but belonging to other places, 2,450 tons register; horse power, 1,200. The number and tonnage of sea-going vessels belonging to Hull have increased since my last report. The river-steamers belonging to the port remain nearly the same; this is also the case with sea going and river-boats belonging to other places, but trading to Hull.

At the late meeting of the British Association, papers were contributed to the Chemical Section by four young men who attend the evening class of Practical Chemistry in the Museum of Irish Industry, Steven's-green, Dublin. This is an encouraging fact to the friends of adult education, and shows how much may be accomplished when the efforts made by industrious men are properly directed.

Home Correspondence.

EXHIBITION IN 1862.

Sir,—In the dedication to her Majesty of the series of lectures on the Great Exhibition of 1851, the subscribing Vice-Presidents and members of the Council of the Society of Arts state that "History does not inform us that any other sovereign of this country has ever shown so personal and affectionate a regard for the progress of the arts, sciences, and industries of the people as your Majesty—a fact which makes us hope that a continued and most auspicious development of them will be the consequence." Is the hope thus expressed to be realised? Is the Council of the Society of Arts again to have the credit of asking her Majesty's countenance and support to a second International Exhibition in 1862? Are the visible utterances of men's minds to be again collected and arranged for exhibition? Are the artists, manufacturers, and scientific men of England to be again urged to come forward and invite their foreign brothers and sisters in industry to a second trial of skill?

I trust that the present Council of the Society will take steps at once to induce so desirable an object, and enable tangible illustrations of the lessons learnt in 1851 to be placed before the world.

What better opportunity can be hoped for than the present? War, which threatened to involve Europe, has ceased. I know of no basis which could be laid so broadly, or which would enlist so large a sympathy as that upon which the property of nations is built, viz., a competitive display of industries. Are the working classes of England, who were taught their first lesson in competitive industry in 1851, not to have an opportunity of showing how they have profited by it? Much must have resulted—our exports have been greatly increased—these are the products of greater skill on the part of the artisan—and the results of the extended application of improved machinery.

England exports but little raw produce, and the wants of other countries, and the character of the articles they demand, can be more readily learnt by means of Exhibitions than in any other way. Can intellect meet intellect, skilled labour in England meet that from abroad, the produce of France be juxtaposed with that of England—the machinery of our workshops with the rude implements from the East—and no want be ascertained or requirement supplied? Have our colonies yielded no new raw produce? Is not India opening up to a greatly extended trade? Can England hope for no new imports and extension of trade with Africa? Are not the markets of Japan more freely open to us now than ever they were, and may we not hope that an Exhibition in 1862 would afford a display of the beautiful industries of that country, a display which in itself would teach lessons unthought of by many of our manufacturers, and which would react with great force upon the industries of this country?

Since the Council announced its intention to press forward an Exhibition in 1861, many of our colonies have arranged to hold preliminary Exhibitions, and show how readily they accept the offer to collect their products for exhibition in the markets of the mother-country. Are the advantages of such efforts to be lost to us for want of energy on our part? Russia, which is pushing forward so energetically, and establishing her workshops so largely throughout her empire, would doubtless become an important contributor.

Are there not ample grounds then for the Council to at once come forward and urge upon her Majesty and H.R.H., the President of the Society, the immediate declaration of an intention to realise as far as they can the hope set forward in the dedication above quoted, by holding a second International Exhibition in London in 1862? I am, &c.,

H. D.

Moorgate-street, Oct. 11, 1859.

THE WESTMINSTER BELL.

Sir,—In this age of improvement in England, it appears strange that the founding of large bells should be so little understood, and that the second Westminster Palace bell should so soon have proved a failure, like its predecessor, especially after all the care bestowed upon its re-casting by another founder.

In Belgium, within a twelve hours' journey from London, large bells are numerous, and were those of the Carillon Tower of Bruges examined, possibly the cause of the defect in our "Big Ben" might be ascertained. The great bell in that tower, upon which the hour has been struck for more than a century, was re-cast A.D. 1741, from those melted when the woodwork over the present tower was struck by lightning. The former bells were made by Melchior de Hoese, A.D. 1675. An older set of bells were first placed in this tower A.D. 1503, by Simon Waaghenlis, of Mechlin, these carillons being then recently invented at Alost, near Bruxelles. There are many large bells in this tower to complete the four octaves still perfectly musical. A larger number of bells are in the cathedral tower at Antwerp, and few are more perfect than those of Courtrai, and most of the principal towns have their carillons, which chime each quarter of an hour. Those of Bruges (considered the finest in Belgium), to which I particularly refer, are suspended on a massive wooden frame, and are struck externally by hammers, so balanced as to be raised by wires and catches, moved by metal pegs let into a brass cylinder, whereon four airs are set, as upon a barrel organ. A set of keys are also connected with these hammers, upon which professors usually play for an hour three times a-week, from noon till one, each Sunday, Wednesday, and Saturday, enlivening the inhabitants with the recent music of the day. Some of the large iron hammers appear to be coated with some softer material where the bell is struck. There is one bell (La Cloche de Notre Dame) which was brought from that tower many years since, and placed by itself in a lower room, which is swung, and tolled on days of fêtes and rejoicings: this is said to weigh 36,000 lbs.

The bells of the cathedral (Saint Sauveur), that were partly melted about twenty years ago, were recast in pits dug in the churchyard, and have been tolled ever since put up. The rich deep tones of these bells, and of the churches of Notre-Dame, Saint Jacques, and Saint Gilles, are peculiarly solemn and grand when sounded for mass on Sunday mornings.

In reading the account of the first "Big Ben," I noticed a great disproportion between the thickness of the head and the sound bow, as compared with the relative diameters, and it struck me that the vibrations could not be in harmony. I have not seen the measurements of the second casting, but I would suggest whether, if the same relative thickness was adhered to, the disproportion might not in some way account for the disaster.

Would it not be worth while to let some competent persons measure the large bells as well as their hammers, and seek information from those which have been so long in use at Bruges.

Now, assuming that the Westminster bell (taking Warner's card for authority) was 50 or 55 inches diameter at the head, the metal was stated to be three inches thick, and at the mouth 100 or 110 inches, the sound bow above should not have exceeded 6 inches in thickness, whereas it was stated to be 9 inches, which must affect the vibrations.

As many bells are indented where struck by clappers or tongues, the revolving head was an ingenious provision for bells rung in our violent English fashion, but "Big Ben" was only intended to be quietly suspended from a beam, and struck upon one point, so possibly a boss (ornamented) would have sufficed to receive the stroke of the hammer, without affecting the sound of the proportionate thinner ring, or necessitating this great increase of thickness. At any rate, before we recast poor "Ben," let us obtain some more practical information from our neighbours than we possess at present.

I am, &c.,
R. DENNIS CHANTRELL.

MODERN NAVAL WARFARE.

Sir,—Modern ordnance has now necessitated reformation in naval construction as a matter of such importance, that I presume good service may be rendered to public interest by renewing, simultaneously, attention to the following communications which appeared in the *Times* of the 12th January last and 7th October inst.:—

(*Times*, 12th Jan., 1859.)

TO THE EDITOR OF THE "TIMES."

Sir,—Many suggestions have of late been brought before the public on the construction of gun-boats, mortar-boats, and floating batteries, with a view to make them invulnerable; and I now beg to add my views on that subject. Why not make the floating body for such special services, up to the line of its load displacement, a solid mass of material, of such specific gravity lighter than water that it shall not sink, however much it may be perforated by shot? It appears to me that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flocks, hemp, and other light material, which, by the aid of a solution of gutta percha, or other chemical process, would form a solidifying mass, so tough that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and therefore unsinkable, however perforated by shot, and capable of carrying armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. Such vessels of light draught accompanying fleets of war as tenders to line-of-battle-ships, whence they might be manned and stored as occasion might require, would, I submit, form a useful auxiliary available for shore service, or for attacking land batteries, which deep draught ships of the line cannot approach, and would be sunk if they could.

I may observe that this idea was first broached by me two years since as being applicable to the construction of vessels for carrying treasure.—They might be wrecked ashore, but the treasure would be recoverable.

I am, Sir,
Your very obedient servant,
CHARLES ATHERTON.
Woolwich Dockyard, Jan. 10, 1859.

(*Times*, 7th Oct., 1859.)

NAVAL AND MILITARY INTELLIGENCE.

Since the *Trusty*, 14, steam floating battery, returned to her former moorings opposite Upnor Castle, Chatham, she has undergone an examination in order to ascertain the amount of injuries she had met with during the experiments that were made on her, with the view of testing her capabilities of resisting the effects of the shot fired from the Armstrong cannons at Shoeburyness. The result of the survey has demonstrated that this new kind of iron cased floating batteries presents comparatively no resistance whatever to the shots of the Armstrong guns. Although the *Trusty* is covered with massive wrought iron plates, of extraordinary thickness, yet every shot that struck them shivered the plates to pieces, and entered the vessel; some of the shots, it is evident from the examination, having passed through the iron plates and beams of the battery on one side, and through the timber and iron casing of the vessel on the other. The battery presents the appearance of having been most severely handled; and it is the unanimous opinion of the officers and others who have examined her, that vessels of this class will be found to be almost entirely useless when fired upon by guns of the Armstrong class.

It having been thus demonstrated that iron-cased ships must go to the bottom under the fire of modern ordnance, and recent events having also shown that ships of the ordinary build may be sunk by the fire even of an extemporized Chinese fort, the time has arrived when, as it appears to me, the principle of naval construction referred to in my letter published in the *Times* of the 12th January last may be appropriately revised. With a view to promoting this object, I now beg to suggest that if a fund to the extent of £250 only were publicly subscribed and placed at the disposal of the Council of the Society of Arts, Adelphi, London, to be awarded as premiums of £150 and £100 for the discovery and specification of the materials and process of manufacture most available for producing a combination of materials constituting a solidifying pulp possessing in the highest degree the properties of specific lightness, toughness, non-absorption of water, and cheapness, or a metallic cellular body having the same properties, I have no doubt that, at a moderate cost per ton of shipping, existing vessels may rendered unsinkable, and that a new modification of ships of war of all classes may be devised, such as may obviate the horrors which appear to be otherwise inevitable in maritime warfare under the fire of modern ordnance. Wholesale perdition being thus obviated, the power of nations will again be determined, as heretofore, by the virtues of personal prowess and endurance rather than by chicanery and mechanical device.

I am, &c., CHARLES ATHERTON.
Woolwich Dockyard, Oct. 11, 1859.

Proceedings of Institutions.

Bradford Mechanics' Institution.—The opportunity of the meeting of the Social Science Association was taken by the managers of the Bradford Mechanics' Institution to hold their annual *soirée* for the distribution of prizes and certificates to the students at the last examination at the Society of Arts, on Wednesday evening, the 12th inst. The meeting was held in St. George's-hall, which was crowded.—Lord Brougham occupied the chair.—Mr. J. V. Godwin, chairman of the Institute, read a report, giving a history of its origin and progress since its institution on the 14th of February, 1832. It had been constituted and administered by working men. The members had varied in number from 1,200 to 1,400.—Lord Brougham said he had no conception, before his arrival in Bradford, of the flourishing state of that great Institution. It appeared to him to stand, he would not say singular, but amongst the very first in point of flourishing and success. In every one particular, since 1832, there had been a regular increase in the number of members, in the funds, in the library, and the most important of all, an increase in the number of the books lent out, and an improvement in the character of the books for which there was a demand of readers; but that which chiefly delighted him to find was the great proportion of working men who took part in the Institution. Taking the maximum number of members at 1,500, of these about 1,000, or two-thirds, were working men. This was a most gratifying circumstance, for Mechanics' Institutions had been derided as having been established for working men, but were more beneficial to others of a superior class of society than to that for which they were originally designed. Lord Brougham proceeded to urge the benefits which working men were deriving from such institutions; and reminded them that the attainment of knowledge would increase their political power; for experience told them on every soil that "they who think must govern those who toil." Their library now contained upwards of 7,000 volumes, and he was glad to learn that they were increasing year by year, and that those that were read were of a superior character, showing a more improved taste on the part of the readers. His lordship concluded by ordering the distribution of the prizes to the successful candidates, and said that afterwards prizes given by Mr. John Cassell (than whom no man had been a greater benefactor to the working classes) for essays written by working men would be awarded. Having, with Lord Shaftesbury, Mr. M. D. Hill, and Lord John Russell, had these essays placed before him, he could testify to the thought and talent they exhibited. The prizes and certificates were then distributed. The Earl of Shaftesbury said that he looked at Mechanics' Institutions as great systems of education, as great subsidiary means for carrying on the education acquired in early life, and as a great mode of civilising the masses of the population,—enabling them to retain what they had acquired and to add to their stores of knowledge. The only complaint he now heard of these Institutions was that they did not precisely answer the purpose for which they were originally intended, and that they did not educate and train the class for which they were founded. This might be true for other counties in England, but it was not so of Yorkshire; and of this he was quite sure, that even if the system had failed as to the particular class for which it was first intended, it had not failed altogether, for thousands, and many thousands, were enjoying its benefits. Let them rejoice that these associations had been instituted, and by degrees they would be extended so as to embrace the class for which they were originally intended. His lordship then mentioned the importance of better buildings being provided for these Institutions, which he considered ought to have a status and position in the eyes of the people, and possess a building which the working-man might call his own. He trusted that working-men would not be satisfied on all occasions merely with going to the reading room, and there passing an hour in conversation and the pursuits of literature, but that they would take home choice works to read to their wives and children, and thus enlighten, cheer, and he might say sanctify, the domestic hearth. Mechanics' Institutions were grand supplements of the early closing movement, which had already begun to pervade all the towns of the empire, as they would prevent that movement from being perverted into an opportunity to men to go to receptacles of vice and folly, by profitably occupying the working-man, and thus withdrawing him from temptation. He, therefore, rejoiced much to see the thriving condition of that association. There was no reason at all why labour should not be consistent with literature and knowledge, and knowledge and literature consistent with labour. That which kept the body in a healthy and vigorous state also kept the mind in a healthy and vigorous state. His lordship concluded by moving the following resolution:—"That this meeting desires to express its sympathy with the great work of popular education, and recognises the progress which has already been made as an earnest of still further success."—Mr. Commissioner Hill seconded the resolution.—The meeting was afterwards addressed by Sir J. Napier, Mr. E. Baines, M.P., and other gentlemen, and separated after passing a vote of thanks to the chairman.

Glasgow Athenæum.—The prizes and certificates awarded to the candidates from this Institution at the last Examinations of the Society of Arts, were presented to the successful competitors, at a meeting held on the 4th inst. The winter class season was opened on the same occasion Mr. Sheriff Bell occupied the chair. Mr. Sheriff Bell said—That having had the honour of being placed in the chair that evening, he might safely congratulate the Glasgow Athenæum, looking at the large and brilliant audience, on the favourable commencement of their winter campaign. He had long entertained the conviction that this Institution was one of great utility. It had afforded easy access to thousands of young men for lectures and books of the best description. It had also given to hundreds annually systematic education in well-conducted classes. In the reading rooms and library they had held pleasant intercourse together; and, in short, it was just such Institutions as this that marked the progress of a great and civilised country, and it was to such Institutions that its members, when removed far away across oceans, looked back with interest, with enthusiastic ardour. The long list of Presidents, Vice-Presidents, and Directors showed that the men of the best intellect and the best position in the West of Scotland—and even farther off—had taken a great interest in this Athenæum. After alluding with much feeling to the loss the Institution had sustained by the death of Professor Nichol, the chairman proceeded as follows:—"I must now proceed to say a few words upon a peculiar feature which has recently been introduced into the Athenæum, and which apparently is calculated much to add to its prosperity, and also to the prosperity of many similar and kindred Institutions. The Society of Arts of London is an old-established body—a most honourable body, both from its purposes and from the class of its membership. It has existed, I believe, for upwards of 100 years. In 1851 it gave the greatest aid to Prince Albert in his extensive and admirable scheme of the Exhibition of that year; and in 1856 a new idea occurred to its members—that of encouraging, by means of honorary rewards given to the best students, encouraging by public examinations, to be held all over the kingdom, a great and a numerous class of young men previously not provided with the same species of encouragement. You are all aware that the system of examination, of testing the capabilities and the mental strength of young men by examination, has long been an approved system in education. In our schools and our colleges the system has long been in use. In admissions to the learned professions—to divinity, law, and medicine—the candidates are tested by examinations in their respective bodies. Recently the Government of this country has seen fit to introduce examinations as passports to the army, passports to important situations in the civil service. You will at once see that these examinations are directed for the benefit of a particular class; they are directed for the benefit of young men who enjoy university education, or who aspire to the ranks of the army or to important civil offices. But there are hundreds of thousands of young men who have no such ambition, who, nevertheless, are most anxious to acquire a character for intelligence and sound information in the particular walks of life to which they are to devote themselves. Now, the idea which seems to have occurred to the Society of Arts is this—that they would institute a set of examinations which would be calculated to bring forward and encourage that class of young men." Mr. Sheriff Bell then explained, in some detail, the Society's system of Examinations, which he warmly commended. He drew special attention to "an admirably digested statement of the Society of Arts' scheme," by Mr. Alex. Richardson, Head Master of the Western Institution, and Lecturer on Logic at the Athenæum. The author says that in these examinations "the student knows and feels that he is competing, not with the narrow circle of his own class, whose acquirements have been measured by him, but with hundreds of eager, plodding, studious youths, in every considerable town of the empire, stimulated by the consciousness that their success in the generous contest is anxiously watched by their respective families, directors, and trustees." Again, he says—"It hardly requires to be added, that the proposed examinations being conducted by examiners utterly unconnected with any particular institution, and acting only by consent of the Society, must be presumed to be more impartial in their estimates than can be expected from any other arrangement." After describing in detail the success which the candidates from this Institution, as well as from another in the same city—the Glasgow Mechanics' Institution—had achieved, the chairman proceeded:—"I look upon these certificates, now that this Society is assuming the character which it is—now that unquestionably it appears to be becoming a national institution—as most valuable. And when we find that there are at least three hundred societies affiliated to the Society of Arts, scattered throughout the whole land, and numbering the most eminent Mechanics' Institutions, Athenæums, and other similar Institutions in the country—when we find such men as Lord Brougham, Sir John Bowring, and others, going to Manchester and Leeds, distributing these very certificates to the successful students—looking to all these things, I consider it becomes an object in a young man's ambition in commercial life, or in preparing to engage in the ordinary business of life, to be possessed of one of these certificates to show that he has studied those branches of knowledge. * * * * I was anxious to take this opportunity of explaining somewhat at length the objects of this scheme, which has recently, I may say, started into existence, but which appears to me likely to be of very great benefit to the cause of education in this country. I do not wish to speak in too exaggerated terms about the probable good it is to effect—that is in the hands of Providence—but as far as, humanly speaking, we can judge of it, and looking at the impartial and honourable manner in which it appears to be conducted—looking at the life and spirit which it is calculated to put into the local institutions, and even into the primary schools—for young men at school will begin to think of looking forward to this, and young men, on leaving school, will join the Institutions with the view of carrying the knowledge acquired at school into the competition and examination—looking at all these practical advantages, I cannot but think that the Society of Arts have conferred a benefit upon the country, perhaps likely to be a still more permanent benefit than even what they did for the great Exhibition of 1851. I certainly, in conclusion, will just say this, that I am not one of those who think that all this toil for human culture is likely to be unavailing. I take a more hopeful, and, I believe, a truer view of the subject. I think where human intellect is honestly exercised with the view of advancing the intellectual interests of our fellow-men, the probability is, in a free and enlightened country like this, that the whole population will be advanced some steps up the ladder of knowledge, and thereby that their civilisation and their happiness will be increased." The certificates and prizes were then distributed to the successful competitors. The Chairman then said that the Very Rev. Principal Barclay had agreed to be present, but had been prevented; and Bailie Gourlay would therefore move the resolution.—Bailie Gourlay then, in a few remarks, proposed, "That the Athenæum classes deserve the support of the commercial young men of Glasgow."—Mr. Jas. Hedderwick seconded the resolution. The ingenious and admirable scheme of the Society of Arts must, he should think, be eminently instrumental in imparting to such institutions as this a new, solid, and permanent attraction. The learned sheriff had shown that the certificate of the Society of Arts was something worth struggling for, even at some sacrifice. In the whole scheme of the Society of Arts he recognised the growth of a great social fact—namely, the opening up of the paths of honourable ambition to all. The fiat had gone forth, that in the fair fields of intellect there should be no degradation of caste. He saw in this movement a great union and co-operation for the advancement of the public good—fields where no differences distract, and where no interests clash. In this there was everything to encourage the educator and everything to delight the philanthropist. He would merely say, in conclusion, let the good work go on, let it be prosecuted with vigour, and the fruits would be at once abundant and glorious.—The resolution was then put to the meeting, and carried with acclamation. After a vote of thanks to the Chairman and the other gentlemen who had taken part in the proceedings of the evening, the meeting dissolved.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 14th*, 1859.]

Dated 6th August, 1859.

1813. A. S. Stocker and G. J. Farmer, Birmingham—Certain imp. appertaining to articles to be affixed to boots and shoes, and to the feet of animals, and in machinery and means to be employed for producing the same.

Dated 9th August, 1859.

1842. F. L. Lawrence, 50, Berners-street, Oxford-street—Imp. in colouring and hardening elastic gums for dental purposes.

Dated 12th September, 1859.

2074. H. W. Ripley, Bradford—Imp in finishing dyed piece goods.

Dated 14th September, 1859.

2090. S. Hecht, 36, Gresham-street—A new mode of advertising.

Dated 17th September, 1859.

2122. T. Elliott, Manchester—Imp. in lubricators, especially applicable to steam engines.

Dated 20th September, 1859.

2137. A. Manbré, 10, Rathbone-place, Oxford-street—The manufacture of a colouring matter for colouring spirits, beers, vinegar, and other liquids and beverages.

Dated 21st September, 1859.

2148. H. A. Jowett, Sawley, Derbyshire—Imp. in breaks for railway and other carriages, with means of communication between guard or conductor and driver.

2149. J. Blair, Manchester—Certain imp. in the treatment of yarns during the operation of spinning, which treatment is also applicable in "roving," "slubbing," or "doubling" machines.

2152. R. Davison, London-street, London—Imp. in the construction of holders for containing liquid or air and other aeriform fluids, especially adapted for use in refrigerators.

2153. J. Harrison, Glossop, Derbyshire—An imp. in spinning mules, applicable also to the machines called twiners.

Dated 22nd September, 1859.

2156. R. B. Mowbray and T. Coatman, Manchester—Imp. in machinery or apparatus connected with and applicable to steam boilers and heating apparatus.

2158. E. Jones, Dudley, Worcestershire—An imp. or imps. in the manufacture of coke in open coke fires, or heaps.

Dated 23rd September, 1859.

2160. C. J. Parry, Manchester—Imp. in certain apparatus applicable to sewing machines.

2162. T. Bentley, Margate, Kent—Imp. in agricultural implements for gathering and destroying weeds and stubble.

2164. R. James, Manchester—Imp. in machinery or apparatus for covering crinoline, applicable also to braiding fancy patterns for other articles.

Dated 24th September, 1859.

2166. J. Gedge, 4, Wellington-street South, Strand—An improved stamp holder and cutter. (A com.)

2168. J. Coey, Liverpool—Imp. in or applicable to packages for containing butter, lard, and other articles.

2170. T. B. Daft, Tottenham, Middlesex—Imp. in coating metal conductors, suitable for electric telegraphs.

2172. J. Todd, Greenwich—Imp. applicable to screw propellers in the propulsion of vessels.

Dated 26th September, 1859.

2174. J. Fernihough, Dukinfield, Chester—Imp. in pistons, plungers, and buckets.

Dated 27th September, 1852.

2182. R. Coales, 53, Chancery-lane—An improved preparation or preparations for promoting the growth and otherwise improving the hair, and for the application of a certain material for like purposes.

2184. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in mixing or combining and deodorizing oil made from gas tar and other oils. (A com.)

2186. J. R. Piednue, Royal Mint Refinery, Royal Mint-street, Middlesex—An improved apparatus for transmitting motive power. (A com.)

2188. P. J. Lejeune-Chaumont, Faubourg Vivegnies, 138, Liége—Imp. in fire-arms and ordnance, and in projectiles and cartridges to be used therewith.

Dated 28th September, 1859.

2190. W. Collins, Salford, Lancashire—Imp. in stand pipes for hydrants.

2192. W. J. Dorning, Manchester—Certain imp. in traction engines

2194. E. S. Cathels and S. Splatt, Dover—Imp. in gas meters.
2200. P. Robertson, Sun-court, Cornhill—Imp. in the manufacture of manure.

Dated 29th September, 1859.

2202. C. Stevens, 1B, Welbeck-street, Cavendish-square—An improved steam dredging boat. (A com.)
2203. G. G. Page, Whitehall, and C. Lungley, Deptford, Kent—Imp. in gangways or step ladders, applicable to floating bodies and other useful purposes.
2205. W. Johnson, Horse Shoe-court, London—An imp. in purses.
2206. E. H. Bentall, Heybridge, near Maldon, Essex—Imp. in screw presses.
2207. C. Duplomb, Rue de Rivoli, No. 112, Paris—Imp. in presses for pressing or finishing textile fabrics.
2208. A. W. Williamson, University College, and L. Perkins, Francis-street, Gray's-inn-road—Imp. in steam boilers.
2209. W. Kempe, Holbeck Mills, Leeds—Imp. in machinery for raising the pile of woollen and other cloths.
2210. R. Oxland, Plymouth—Imp. in the treatment of saccharine matters.

Dated 30th September, 1859.

2211. J. Wadsworth, Manchester—Imp. in instruments or apparatus for measuring the quantity, for regulating the pressure, and for controlling the flow or passage of gas used for purposes of illumination, and in the construction of gas burners.
2212. T. Guibal, Hainaut Mines, Mons, Belgium—Modifying the installation and working of cables used in springing up mines.
2213. W. Hartley, Bury, Lancashire—Certain imp. in steam engines.
2215. T. Buckham, Gloucester—Imp. in the switches for railways.
2216. J. O. Smith, 18, Warwick-court, Gray's-inn—Imp. in the construction of children's carriages called "perambulators."
2217. B. Atkinson, Rainham, Essex—Imp. in railway brakes.
2218. W. H. Buckland, Maesteg Iron Works, Glamorganshire—Imp. in the preparation of peat.
2219. H. W. Hart, Fleet-street—Imp. in argand and other gas burners, partly applicable to oil and other lamps.
2220. W. Clark, 53, Chancery-lane—Imp. in railway signal apparatus. (A com.)
2221. J. H. Johnson, 47, Lincoln's-inn fields—Imp. in the construction of apparatus for reworking the waste steam of steam-engines. (A com.)
2222. M. and A. Samuelson, Scott-street Foundry, Hull—Imp. in planing, slotting, and grooving machines.
2223. Hon. W. E. Cochrane, Osnaburgh-terrace, Regent's-park—Imp. in chairs and apparatus for receiving and securing the ends of the rails of railways.
2224. W. V. Edwards, Swindon, Wiltshire—Imp. in the construction of ways and apparatus to facilitate the conveyance of mails, goods, and passengers.

Dated 1st October, 1859.

2226. W. Parkin, Sheffield, and J. Bates, Hyde, Chester—Imp. in wedges for railway chairs.
2229. R. A. Brooman, 166, Fleet-street—Imp. in reverberatory puddling and other furnaces employed in the manufacture of iron. (A com.)
2231. J. Millar, Edinburgh—Imp. in reflectors for diffusing artificial light.
2232. L. Newton, Oldham, and J. Greaves, Staleybridge, Lancashire—Imp. in cop tubes or spools, and in machinery for manufacturing the same.
2233. G. Bridgett, Pilcher-gate, Nottingham—A new mode or method of manufacturing Shetland or other falls from the stocking frame.
2234. J. Wright, Teesdale Iron Works, South Stockton, Yorkshire—Imp. in apparatus for raising water and minerals from mines, which improvements are applicable to raising and hauling weights generally.

Dated 3rd October, 1859.

2235. E. Morewood, Enfield, Middlesex—Imp. in coating metals.
2237. L. H. I. Lemaire, Stamford-street, Blackfriars—Imp. in the manufacture of chenille.
2238. W. R. Earle and E. J. Barnes, Queen's-terrace, Queen's Head-lane, Islington—Imp. in photographic and other portraits.

Dated 4th October, 1859.

2239. G. F. Greiner, 57, Wells-street, St. Marylebone—Imp. in the construction of pianofortes.
2240. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved coupling joint for pipes or tubes of soft metal, caoutchouc, gutta-percha, or other yielding matter. (A com.)
2241. M. A. F. Mennons, 39, Rue de l'Echiquier, Paris—An improved "porte-jupe," or apparatus for suspending dress-skirts and other objects. (A com.)
2242. J. Loftus, Elton Fold, near Bury, Lancashire—Imp. in machinery for combining and carding cotton or silk and wool.
2243. R. and W. Hollis, High Coggs, Witney, Oxfordshire—Imp. in the construction of apparatus for winnowing and dressing grain.
2244. S. R. English, Birmingham—A machine or apparatus for taking copies of writing.
2245. R. Brearley, jun., Batley, Yorkshire—Imp. in means or apparatus for raising the nap or pile of cloths.
2246. W. Backett, Old Kent-road, Surrey—Improved cleansing powders.
2247. W. E. Newton, 66, Chancery-lane—Improved apparatus for generating steam. (A com.)
2248. J. M. Rose, R. Carte, and W. Pikesley, Charing-cross, Westminster—Imp. in drums.

Dated 5th October, 1859.

2251. J. Thompson, Witton, near Northwich, Cheshire, and J. Thompson, Castle, Northwich—The manufacture of salt by an improved and more economical mode.
2253. A. Whytock, 12, Little St. Andrew-street, Upper St. Martin's-lane—A mode or method of applying joined sheets of metal for roofing and other purposes.
2255. J. Shields, Perth, N.B.—Imp. in Jacquard looms or machinery for weaving,
2257. J. J. Eagleton, Birmingham—An imp. or imps. in annealing furnaces.
2259. G. Davies, 1, Serle street, Lincoln's-inn—Imp. in the method of, and apparatus for, vaporizing liquids and heating air. (A com.)
2261. J. Scott, Sunderland—Imp. in the manufacture of anchors.
2263. W. E. Newton, 66, Chancery-lane—Imp. in revolving fire-arms. (A com.)
2265. W. L. Earle, Alfred place, Bedford-square—Imp. in apparatus for promoting the combustion of smoke and gases arising from fuel.
2267. J. Macintosh, North Bank, Regent's-park—Imp. in the manufacture of flexible tubes.
2269. J. Macintosh, North Bank, Regent's-park—Imp. in coating metallic conductors for electric telegraphs.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, October 14th*, 1859.]

October 13th.

936. T. Bird.
938. J. Beattie.
943. A. McDougall.
945. S. Barnwell & A. Rollason.
949. G. Ashcroft.
954. J. Glasgow and S. Hand.
958. J. Hamilton.
959. A. Courage.
971. J. Whittaker.
972. Joseph Seaman.
977. John Freer.
981. F. Edwards & W. Edwards.
985. P. Reynolds & J. Reynolds.
992. Q. Beck.
995. A. W. Williamson.
1008. E. Clark.
1014. C. Mansell.
1019. W. Dicks and W. Hopwell.
1024. R. A. Brooman.
1031. G. Ward.
1035. J. Holmes.
1036. A. W. Gadesden.
1037. E. Humphrys.
1062. Sir T. T. Grant, K.C.B.
1065. C. Randolph and J. Elder.
1079. E. A. Porteus and W. H. Burke.
1100. D. Moore.
1129. W. Clark.
1161. G. G. Bussey.
1183. M. Henry.
1197. W. Clark.
1222. L. D. Owen.
1251. W. C. Cambridge.
1500. G. T. Bousfield.
1654. T. Wright.
1668. J. Morgan.
1718. J. Hartley.
1765. J. Wood.
1774. W. Campbell and G. Worstenholm.
1808. R. T. Pattison.
1909. H. W. Harman.
1944. M. J. Stark.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, October 14th*, 1859.]

October 11th.

2385. A. B. Seithen.
2394. W. Todd and J. Todd.

October 12th.

2405. T. Allen.
2434. A. V. Newton.
2460. A. Lorimier.
2544. C. De Jongh.
2545. P. Fairbairn & R. Newton.

[*From Gazette, October 18th*, 1859]

October 13th.

2403. R. A. Brooman.

October 14th.

2467. G. Blair.

October 15th.

2419. E. Tombs.
2428. G. Wilson.
2432. G. Morton.
2494. L. A. Desacby.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, October 14th*, 1859.]

October 11th.

356. J. Robinson.
371. W. McFarlane.

October 12th.

358. W. H. Smith.
557. R. Mallet.

[*From Gazette, October 18th*, 1859.]

October 13th.

399. J. Hopkinson.

October 14th.

409. E. Leigh.

October 15th.

422. G. R. Tovell and J. Mann.
432. E. Heywood.
761. S. Holt.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,202.	Oct. 3rd.	Glazed and Covered Show Case	Williams and Bate	Birmingham.
4,203.	„ 5th.	Improved Upper for Boots and Shoes	Thomas Ridge	5, Norway-place, Hackney-road, N.E
4,204	„ 6th.	Improved Persian Coal Scoop	Loveridge and Shoolbred	Merridale Works, Wolverhampton.
4,205	„ 19th.	Dog-Cart Phaeton	Charles Sandford Windover	Huntingdon.

Journal of the Society of Arts.

FRIDAY, OCTOBER 28, 1859.

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ARTISTIC COPYRIGHT.

The attention of the Council will be again directed to this subject in the early part of the ensuing Session, and a meeting of the Artistic Copyright Committee will shortly be called, in order to consider what further steps should be taken in furtherance of the objects proposed by the Council.

PRIZE FOR AN ESSAY ON MARINE ALGÆ.

A Prize of £100 has been placed at the disposal of the Council, by Sir W. C. Trevelyan, Bart., to be awarded for "The best Essay on the Applications of the Marine Algæ and their products, as food or medicine for man and domestic animals, or for dyeing and other manufacturing purposes. Competitors must give the results of their original investigations on seaweeds; and they must prepare a series of specimens illustrative of the best modes of collecting, preserving, and preparing the several species. Mere compilations will not be admitted to competition."

The Essays, with accompanying specimens, must be sent to the Society of Arts by the 31st day of December, 1860. Each Essay to be marked "Essay on Marine Algæ," and to have a motto or distinctive mark attached, which mark must also be written on a sealed letter, containing the name and address of the author.

The letters containing the names and addresses of the authors will remain with the Society of Arts, and none will be opened except that bearing the motto or mark attached to the Essay to which the adjudicators award the Prize.

Copies of the conditions may be obtained on application to the Secretary of the Society of Arts.

THE LATE ISAMBARD K. BRUNEL.

The following notice has been contributed by a member of the Society:—

The death, at a comparatively early age, of so distinguished a member of our Society, and of one whose life was devoted to the advancement of works calculated to promote and to extend the advantages to be derived from Arts, Manufactures, and Commerce, requires notice from us.

Mr. Brunel inherited a great name from his father, but he has left that name to his son still greater.

Sir Isambard Brunel, known more by his great mechanical than engineering works, wanted those elements of character required to achieve national greatness which were so pre-eminent in his son. Promptness and boldness, controlled by the greatest caution; the power of enlisting the support of individuals and public bodies by his wonderful facility and accuracy of illustration, and the calm and comprehensive view of every principle he desired to establish in the minds of others—united with great earnestness of purpose, a strict love of truth and an abnegation of self, gave together unlimited confidence in his opinions and judgment.

In a hasty review of his works—and that is all we can give in a notice of this kind—we shall not fail to observe how these elements of his character were exhibited, as well in his early as in his later designs. The proposed Clifton-bridge was the first undertaking to which he was appointed engineer, and this he owed to the fact that upon the reference of the competing designs to two distinguished mathematicians for the verification of the calculations, his alone were pronounced to be mathematically exact.

This introduction to Bristol, where he soon made influential friends, led to his appointment as engineer to the Great Western Railway; and, whatever may be the opinion of the merits of the broad-guage, we find in his plans for this railway that largeness of view which never forsook him. Here he boldly laid down the principle, that if it were expedient to incur the expense of a railway, the more perfect the construction of every part the greater would be the ultimate success. He maintained, before two successive parliamentary committees, through personal examinations of unparalleled duration, that railways ought to be made so perfect as to attain the highest speed consistent with safety. To accomplish this, he widened the guage, enlarged the engines, supporting them and the carriages on six or eight wheels, instead of four; and spared neither labour nor expense to produce a line which should combine the maximum speed with the minimum risk, and with the greatest comfort to passengers. Upon these points no line yet constructed, taking advantage of every recent improvement, has surpassed the Great Western as finished by Mr. Brunel.

The personal labour—mental and physical—attending the construction of this railway will be thoroughly understood by our readers, when they recollect that every part of it had to be specially designed; the form of rail incidental to the adoption of the principle of continuous bearing; the construction of engines of a size and power then unknown; the erection of bridges, viaducts, and embankments, with reference to the greater loads and higher speeds proposed for this line, every part was novel, and was designed and drawn by himself.

While this railway was in progress, two or three other interesting works occupied his attention, among them were the Hungerford Suspension Bridge (the centre opening of which was the largest span then achieved, and is still the largest in England), the Sunderland Docks, and the *Great Western* steamship. This, we may say, was the pioneer to the *Great Eastern*, and was in size and power so far beyond anything then built as to excite ridicule among the ignorant, and surprise among the more thoughtful and intelligent observers. This ship was designed with a view to increase the rapidity of communication between England and America, in about the same proportion that Mr. Brunel calculated the *Great Eastern* will increase that between this country and India and Australia.

But to return to Mr. Brunel's railway engagements, which, notwithstanding the opposition to the broad-guage, extended throughout the West of England, to Penzance in one direction, and to Milford Haven in the other.

In the construction of this series of lines from London to either terminus, his high engineering talent had ample opportunity of development.

The viaduct at Hanwell, the Maidenhead bridge, the bridge over the Thames at Windsor, the Box tunnel, were in their day striking illustrations of the perfect knowledge he possessed of the strength of materials;

his skill in combining them so as to secure in the highest degree the advantages of all; and the accuracy and soundness of the calculations upon which he based the erection of structures which others thought decidedly insufficient for their purpose. Further down these lines we arrive at the Chepstow and Tamar bridges, perhaps the finest specimens of his original and fertile genius. Indeed, the entire line from the Tamar bridge to Penzance exhibits wonderful boldness in design, and lightness and originality of construction; but we cannot now dwell longer on these lines, and must only give a passing notice to his works in Lombardy, to his designs for railways in Australia, and to the very useful services he rendered to the Government during the Crimean war, by superintending the construction of the Renkoi hospitals.

It is impossible, in a brief paper of this kind, to notice nearly all the works of so great a man as Mr. Brunel, whose entire time, almost day and night, for 30 years was devoted to the active pursuit of his profession, but we must not omit a brief reference to the *Great Eastern* ship, which occupied for many years a very considerable amount of thought, involving a careful collection of every fact relating to ocean steam navigation, which tended to show why, to this time, ocean steam navigation had been a failure.

One distinguishing feature of his original mind was a strong conviction that mechanical invention, and the science of engineering, should not be confined in its application to special localities, but that its greatest triumphs were to be sought for and found in overcoming, if possible, the physical difficulties which check the most perfect intercourse between distant nations.

He began with America,—and what subject could more worthily employ the mind of a great man than the consideration of the means whereby the intercourse between England and America, the most civilized and enterprising nations in the world, could be so facilitated as to bring them with regularity and certainty within a few days of one another.

No sooner was the power of the *Great Western* steamer an established fact, than public companies, private shipowners, and at last the government, vied with each other in building ships to surpass her. But here again Mr. Brunel made another step in advance, and the *Great Britain*, an iron ship, was designed and built. This ship, of 3,600 tons burthen, was as much larger than any existing ship as the *Great Western* had been in her day, but several important novelties in her construction exposed him to the brunt of ignorant criticism and prognostications of failure.

The *Great Britain*, however, triumphed over all her difficulties, and was a perfect success in an engineering point of view, and is now running between this country and Australia, as one of several ships of equal burthen.

The reputation obtained by these ships led to his appointment as engineer to two ocean steam navigation companies, the Australian Steam Navigation Company at the end of 1851, and the Eastern Steam in 1852.

He advised the directors of the Australian Company, in 1851, to build ships of 5,000 tons burthen, to run the entire distance from England to Australia without stopping for fuel. This advice was not adopted; small ships were built, and failure was the result; but he was more fortunate in his association with the Directors of the Eastern Steam Navigation Company, who, having replied favourably to his inquiry whether, if he could satisfy them that he could build a steam-ship to carry cargo at the rate obtained by clipper ships, could deliver such cargo at Calcutta in 30 or 34 days, could provide ample accommodation for first-class passengers, and carry fuel for her voyage out and home, they would support such an enterprise—he at once produced his plans for the great ship now exciting so much attention.

The history of this ship is brief; every leading principle as to size, form, construction, and motive-power, was decided before he published his views to the directors of the Great Eastern Company.

The writer saw the plans, and had the advantage of hearing the reasons for the adoption of the size, form, and motive-power explained, early in 1851, and we may briefly state them thus:—

1. As to Size and Cost.—These were fixed after most careful consideration of the space required for coals, for a sufficient number of first-class passengers and tons of cargo, to be profitably carried at a rate as low as that then paid to clipper ships.

2. As to Form and Power.—The duration of the voyage being determined, such form and power was adopted as would, consistently with other necessary conditions, accomplish the object in view.

3. As to Strength and Construction.—Here it was necessary first to satisfy the scientific world, and then the public, that a ship nearly double the length, and six times the burthen of any existing ship, was not only as safe, but safer, than any other yet built.

These results were attained as to strength, by the cellular structure of hull and deck, never before adopted in ship-building, and by the combination of a perfect system of transverse and longitudinal bulk heads—as to form and power, by the hollow bow and the beautiful run aft, which all have so much admired, and by the novel application of the joint action of the paddle and the screw; and as to size and cost we can safely say that, notwithstanding the disadvantages arising from the failure in the contract for building this ship, so that to a great extent up to the launch it was finished under most unfavourable circumstances by the directors themselves, still its cost will not preclude the attainment of everything originally contemplated, for even if it be £200,000 more than the estimate, mainly owing to the unfortunate circumstance above alluded to, still, trade and the demand for rapid communication with the East and Australia has increased in a greater proportion since this ship was projected, and this increased demand for the advantages offered by such a ship, by commerce and the government, will more than compensate for the extra cost, though it is difficult to estimate the value of the loss to the company in the completion of the ship, of the advice and knowledge of their late engineer.

We have so far noticed Mr. Brunel only as an engineer, whose last great work is calculated to do more for civilisation, manufactures, and commerce than even the railway system of England; for who can imagine the great results to arise from bringing India, by a route independent of all nations, within 30 days of our shores? and may we not ask, if this ship can do so much, will not more be done by others? If this does 15 knots an hour, at the working cost of a clipper ship, may not 25 knots an hour be done at a cost equal to that of our present overland route; and what mind can then grasp the importance, commercially and politically, of bringing the commerce of India and Australia within 20 or 23 days of England?

We have but little space left to touch upon Mr. Brunel's character as an artist and patron of Art. His early drawings and his later professional designs, prove his high feeling for the purest styles of art; but his Shakesperian pictures, the result of a commission given to twelve of our first English artists, and which produced, among other beautiful paintings, the finest picture of modern times (Sir Edwin Landseer's Midsummer Night's Dream), must place him high among our patrons of Art, quite independently of his otherwise beautiful collection of paintings and articles of vertu.

A few words upon his private character, and we must conclude. By those who knew Mr. Brunel he was beloved. In youth a more joyous, kind-hearted companion never existed. As a man, always over-worked, he was ever ready by advice, and not unfrequently to a large extent by his purse, to aid either professional or private friends. His habitual caution and reserve made many think him cold and worldly, but by those who saw his exterior only could such an opinion be entertained.

His carelessness of contemporary public opinion, and his self-reliance on his own character and on that of his works, were carried to a fault. He was never known to court applause. Bold and vigorous professionally, he was modest and retiring in private life; and sad indeed is it to think that he is carried away in early life (in his fifty-fourth year), when that work upon the results of which, not to this country only, but to the world, he attached the highest importance, is on the eve of successful completion.

BRITISH ASSOCIATION, ABERDEEN, 1859.

The following paper was read in the Mechanical Section:

Some Experimental Researches to Determine the Density of Steam at all Temperatures.—By William Fairbairn, F.R.S., and Thomas Tate, F.R.A.S.

I propose to give a short sketch of an apparatus, and the results of the earlier experiments which, in conjunction with my friend Mr. Thomas Tate, I have been investigating by direct experiments, with the intention of determining the law of the density of steam and other condensable vapours; and thus to solve a hitherto almost untouched problem by an experimental method, which will verify or correct the theoretical speculations in regard to the relation between the specific volume and temperature of steam and other vapours. The experiments are being conducted, it is believed, upon an entirely novel and original principle, and one which is applicable at any temperature and pressure capable of being sustained by glass vessels.

For a perfect gas, the law which regulates the relation between temperature and volume is known as Gay-Lussac's or Dalton's law, and is expressed by the equation:

$$\frac{V \times P}{V_1 \times P_1} = \frac{458 + t_1}{458 + t} \text{ .... (1.)}$$

Now, the density of steam has been determined with accuracy by direct experiment at the temperature of 212°, —and at that temperature only,—by the method of Dumas. At 212° Fahrenheit, its density is such that its volume is 1,670 times that of the water which produced it. Hence assuming Dalton's law to hold true for steam, and substituting these values of volume, temperature, and pressure, we get for the volume of steam from a unit of water at any other temperature:—

$$V = \frac{1670 \times 15}{670} \times \frac{458 + t}{P},$$

$$\text{Or, } V = 37\tfrac{1}{3}\,\frac{458 + t}{P}, \text{ .... (2.)}$$

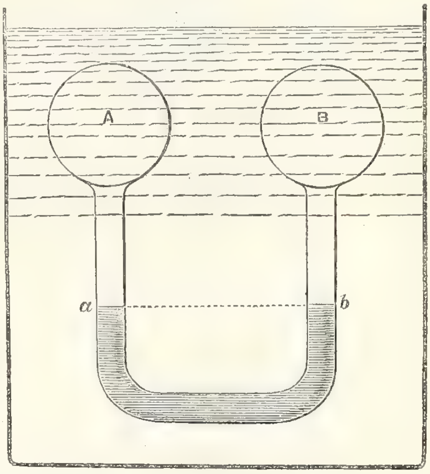
These are the well-known and received formulæ from which all the tables of the density of steam have hitherto been deduced, and on which calculations on the duty of steam-engines have been founded. Up to the present time, however, this formula has never been verified by direct experiment, nor are the methods hitherto employed in determining the density of gases and vapours applicable in this case, except at the boiling temperature of the liquid at the ordinary atmospheric pressure. But, on the other hand, theoretical speculations throw considerable doubt on the accuracy of the above formula when applied to steam and other condensable vapours. Several years ago, Dr. Joule and Professor William Thomson announced, as the result of applying the new dynamical theory of heat to the law of Carnot, that for temperatures above 212° Fahrenheit, there is a very considerable deviation from the gaseous laws in the case of steam. Later, in 1855, Professor Macquorne Rankine has given a new theoretical formula for the density of steam, independent of Gay-Lussac's law, and confirmatory of Professor Thomson's surmise. But as yet these speculations need the evidence and verification of direct experiment.

The density of steam is ascertained by vaporising a known weight of water in a glass globe of known capacity, and noting the exact temperature at which the whole of the water becomes converted into steam. From these three elements,—volume, weight and temperature,—the specific gravity is known. But in pursuing this method, these two difficulties must be overcome. First, the pressure of the steam renders it necessary that the glass globe should be heated in a strong and consequently opaque vessel. Second, as steam rapidly expands in volume for any increase of temperature beyond the temperature of saturation, it would, in any case, be impossible to decide by the eye the temperature at which the whole of the water became vaporised. The temperature of saturation, or temperature at which the whole of the moisture is converted into steam, whilst no part of the steam is superheated, must be determined with the utmost accuracy, or the results are of no value.

The difficulties thus resolve themselves into finding some other test of sufficient accuracy and delicacy to determine the point of saturation. This has been overcome by what may be termed the saturation gauge; and it is in this that the novelty of the present experiments consists.

To illustrate the principles of the saturation gauge, suppose two globes A and B, Fig. 1, connected by a bent tube containing mercury at *a b*, and placed in a bath in which they can be raised to any required temperature. Suppose a Torricellian vacuum to have been created in each globe, and 20 grains of water to have been added to A and 30 or 40 grains to B. Now, suppose the temperature to be slowly and uniformly raised around these globes; the water in each will go on evaporating at each temperature, being filled with steam of a density corresponding to that temperature, and the density being greater as the temperature increases. At last a point will be reached at which the whole of the water in globe A will be converted into steam, and at this point the mercury column will rise at *a* and sink at *b*; this is the saturation test, and the cause of its action will be easily seen. So long as vaporization went on in both A and B, and the temperature was maintained uniform, each globe would contain steam of the same pressure, and the columns of mercury *a*, and *b*, would remain at the same level. But so soon as the water in A had vaporized, and the steam began to superheat, the pressure in A would cease to remain uniform with the pressure in B, and the mercury column would at once fall and thus indicate the difference. The instantaneous change of the position of the mercury is the indication of the point at which the tem-

Fig. 1.

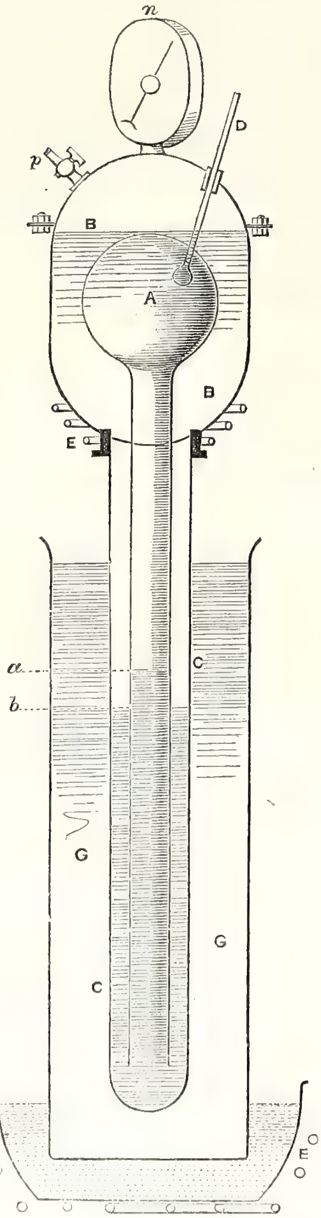


perature in the bath corresponds with the saturation point of the steam in A.

To show the delicacy of this test, I may instance that at 290° Fahrenheit, the mercury column would rise nearly two inches for every degree of temperature above the saturation point, as the increase of pressure arising from vaporization is twelve times that arising from expansion in superheating at that point, and a similar difference exists at other temperatures.

The apparatus, as employed for experiment, varies according to the pressure and other circumstances of its use. Fig. 2 represents one of the arrangements which has been employed with success. It consists of a glass globe of about 70 cubic inches capacity, in which is placed, after a Torricellian vacuum has been formed, the weighed globule of water. The globe with the stem is shown at A; this is surrounded by a copper boiler, B B, prolonged by a stout glass tube C C, enclosing the globe stem. This copper boiler forms the water and steam bath through which the globe is heated, and in fact corresponds to the second globe, B, in the former figure. The fluctuating mercury column, or saturation guage, is placed at the bottom of the tube C C, and the saturation point is indicated by the rise of the inner mercury column *a*, and the fall at the same time of the outer mercury column, *b*. As soon as the whole of the water in the globe A is evaporated, there is an instantaneous rise of the inner mercury column to restore the balance of pressure, and that progressively with the rise of temperature.

Fig. 2.



As an auxiliary apparatus the boiler is provided with gas jets, E, to heat it, and with an open oil bath, G, to retain the glass tubes at the same temperature as the boiler, and this oil bath is placed on a sand bath, and also heated with gas. A thermometer, D, registers the temperature, and a pressure guage, *n*, the pressure of the steam; and a blow off-cock, *p*, serves to reduce the temperature when necessary. A number of results have already been obtained, but they are not yet sufficiently advanced to be made public. The following numbers have been, however, approximately reduced from the theoretical formulæ given above, and the experimental results may illustrate the use of this method of research. The most convenient way of expressing the density of steam is by stating the number of volumes into which the water of which it is composed has expanded. Thus one cubic inch of water expands into 1670 cubic inches of steam at 212° Fah., into 882 cubic inches at 251°, and into 400 cubic inches at 304°, and so on; in this way the following numbers have been computed:—

	Volume of Steam.		
Temperature.	By Formula.		By Experiment.
244°	1,005	...	896
245°	969	...	890
257°	790	...	651
262°	740	...	680
268°	680	...	633
270°	660	...	604
283°	540	...	490

These determinations at pressures varying from ten to fifty lbs. above the atmosphere, are not accurate reductions from the experimental results, but only approximations. But they uniformly show a decided deviation from the law for perfect gases, and in the direction anticipated by Professor Thomson, the density being uniformly greater than that indicated by the formula. I hope by the time of the next meeting of the Association, with the assistance of my friend Mr. Tate, to be enabled to lay before the section a series of results which will fully determine the value of superheated steam, and its density and volume as compared with pressure at all pressures, varying from that of the atmosphere to 500 lbs. on the square inch.

GOTHIC ARCHITECTURE AND SCULPTURE.

For several weeks past, an interesting discussion has been going on in the columns of the *Building News*, arising out of a letter addressed to the editor of that journal by Mr. John Bell,* in which the important question, "Is Gothic architecture in harmony with the highest class of painting and sculpture?" was opened up. Mr. Bell fears not, "at least in its present state, or in any phase which it has as yet taken." He says:—

"As a broad proposition, do not in Gothic architecture the paintings go into the windows, and the sculpture into spaces where they are pinched, and occasionally contorted? And supposing paintings are placed on the walls, are not their harmony and effect liable to be injured, if not destroyed, by the rainbow tints cast by the windows, which we all feel should, in Gothic structures, be all more or less coloured? And if, in the same character of architecture, statues are placed of a scale and treatment, whether poetic or portrait, suitable to the dignity of their subjects, are they not apt to be out of harmony with the structure? I fear that the more the artist has had experience in these matters, the more readily he will be inclined to answer 'yes.'

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* See *Building News* for Sept. 9, 1859, p. 810.

"There is, no doubt, a style of painting and a style of sculpture that harmonises admirably with Gothic structures, but of what kind is this? Is this first-rate? By no means. It is second-rate; and is this the style of these arts we want to encourage? I should hope not. All the productions of painting and sculpture, to perfectly harmonise with Gothic architecture, must, I fear, be more or less heraldic. They must be accommodating. The paintings must either be in the windows, and of the jewel-like character of composition suitable for that purpose, or they must, on the walls, be quaint and on gold grounds, &c., and the sculpture must be 'architectonic,' which is pretty nearly another name for stiff and unnatural, at least when Gothic is the architecture. I know there are some few cases which may be brought forward as exceptions. I could name some myself, but still I hold that they are exceptions. I fear sadly that it is too true that Architecture in her Gothic house does not hold out a ready welcome to her sisters Painting and Architecture. It is true that she invites them, and says she will be very glad to see them, but then she says, 'You must behave yourselves. You must do so and so! You must not give way to your natural impulses!' I believe that every word I have said here is backed by the experience of every painter or sculptor who has been engaged in the New Houses of Parliament."

In the following number of the same journal, the editor draws particular attention to Mr. Bell's communication, while expressing dissent from his conclusions. In this article, the "exceptions" to which Mr. Bell alludes are particularly dwelt upon:—

"If there are exceptional instances of Gothic Architecture, in which sculpture is not pinched and contorted, not architectonic and stiff or unnatural, in which painting is not confined to windows, not more or less than heraldic, or quaint, it follows that these exceptional instances may be imitated—we do not say copied—and reproduced again, so that painting and sculpture in Gothic edifices need not be second-rate. What has been done once may be done again, if architects will work as artists and not as artificers. The exceptions prove the elasticity and almost universality of Gothic architecture, which does not consist alone in pointed arches, clustered columns, and floral ornaments, but in its useful and practical character, in its constructional truth, and in the broad measure which it accords to all who practise the style. The purpose of Gothic architecture is to satisfy the requirements of man, and not to curtail nor stint those requirements in obedience to imagined rules, which are at the best empirical, which are lost amid the hazy traditions of antiquity, and whose reason for being exists only in the crazes of self-styled geometricians. Surely nothing can be more ridiculous than the pretended discoveries of these same geometricians of fancied reasons for the proportions of classic architecture. The parade of a belief in the mystic properties of numbers—the resuscitation of an old figment—is worthy of the worst period of the middle ages. To tell us that our columns must be of this diameter, of that altitude, or have that space between them, without reference to the character of the building materials available, is to make us the slaves of a senseless mysticism, and to bind art in fetters. None but the ignorant believe there is luck in odd numbers, and we have gone too far-a-head in arithmetic to believe in the mystic properties of numbers.

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"If in the majority of Gothic edifices erected during the middle ages, the paintings and sculpture they contained were quaint and stiff, are we justified in believing that these defects were due solely or even principally to the style of the building? We believe not, and imagine that Mr. Bell will concur with us in this opinion, when he calls to mind the character of both painting and sculpture, until the Revival. The defects of which complaint is made, and unfairly imputed to Gothic architecture, arose from the ignorance of painters and sculptors, and they will be found quite as absurd, if not worse, in the works of artists who flourished in pre-Gothic periods. Take the statues of the Romane or Romanesque, and they will be found more pinched and distorted than those of the fourteenth century. The lions in the Alhambra are certainly not natural, and the pictures of Byzantium are more quaint than any painted by Cimabue and his predecessors or followers up to the Revival. It was not to obey any necessities imposed by Gothic architecture that the two sister arts crippled their expressions. Had painting and sculpture been capable of exhibiting more artistic and more natural forms, Gothic architecture would have provided a fitting home for them.

"Of sculpture there are two classes, one to which architecture is the encasing or home, and the other which is ornament to architecture. The last may be called architectonic, but we are scarcely prepared to agree in its being termed second-rate. In classic architecture there was the same distinction, and Mr. Bell's reading would readily supply us with an instance where a Greek sculptor treated the statue of Athene architectonically, much to the disgust of the *οι πολλοι*. The Story is too well known to need further description. Reference will be sufficient to show that architectonic sculpture was known to and practised by the great sculptors of antiquity. If our memory serves us, Dean Milman, who presided at the Society of Arts when Professor Westmacott read his admirable paper on "Statue Painting," remarked, after Mr. Bell had spoken, upon that passage of Plato which mentioned the existence of persons in Athens whose business it was to paint statues;* and the drift of these remarks went to show that a distinction was recognised and practised between sculpture intended for the decoration of architecture, and sculpture which we suppose we must call first-class. In the Renaissance period the same distinction existed, as it does, even at the present day, in Italian buildings. The sculpture of the new Louvre is essentially architectonic in character and treatment. It is anything but first-class, either in design or execution."

The editor then goes on to point out what he considers to be the defects in the style of the New Houses of Parliament, and dwells upon the peculiar merits of Westminster Hall, as being specially adapted for the exhibition of works of art. He concludes as follows:—

"It is particularly unfortunate for the adversaries of Gothic architecture, among whom Mr. Bell is not to be classed, to allude to these points, for they must bring out into strong relief the defects of the horizontal style. If there is one thing obnoxious to the reproach of condeming sculpture to be "pinched and contorted," it is that which compels the sculptor to reduce his figures into stooping postures, to squeeze them into a pediment. Architecture is not a "niggard and martinet" in her Gothic house, for there she makes the painter or sculptor a chartered libertine, leaving him free to follow his inspirations, and independent of the fetters of routine, precedent, and geometrical crazes. If she has been so hitherto, what will she not be hereafter, when she has more fully entered into the phase, on the threshold whereof she now stands, to adapt herself to the civilisation of the nineteenth century, and to satisfy the requirements of the age? Let an opportunity be afforded; let any one of our Victorian Gothic architects be asked to design a building which shall encourage the highest efforts of painting and sculpture, and an edifice will be the result, which, we feel confident, Mr. Bell will admit, welcomes, like a Lady Bountiful, the highest efforts of the sister arts, with greater readiness and freedom than do the Classic and Italian styles."

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* See present Vol. of *Journal*, p. 233.

The subject thus thoroughly opened up has produced many communications to the editor of the above-mentioned journal, some in opposition to Mr. Bell's views, and others in support of them. The arguments adduced on both sides tend to show that the right conclusion depends very much on the question how far Gothic architecture can be adapted to the requirements of high-class sculpture, for most of the writers acknowledge the shortcomings of the Gothic style in this respect, as shown by the "examples of the past."

The subject is one of much interest, and the whole discussion, which necessarily involves considerable detail, is well worthy of perusal.

Home Correspondence.

MERCANTILE STEAM TRANSPORT ECONOMY.

Sir,—I shall be obliged by your noticing the following *errata* which occur in the *Society of Arts Journal* of 14th inst.:—

Page 726, col. 1, line 21—for 112·10 read 11,210.
,, ,, 2 ,, 34—for each ind. read each 10 ind.
Page 727, Table D, seventh col., line 27 for 448 read 248
,, Heading of third division—for 25 knots read 20 knots.

I am, &c.,
CHAS. ATHERTON.

Woolwich Dockyard, 25th Oct., 1859.

STEAM TOWAGE ON CANALS.

Sir,—In your *Journal* of the 30th ult. is an article describing an invention, by Mr. W. Robertson, of Strangeways, Manchester, for the traction of barges on canals, and an experiment said to have been made on the Bridgewater Canal. The paragraph states that various attempts have been made to employ upon canals steam-tugs, propelled by paddles or screws, in place of traction by horses, and says the objection against them is always the same—that the waves created by the propelling surfaces injure the banks, &c. It then proceeds to describe the invention, and concludes by saying that the experiments proved highly satisfactory.

In the first place, the experiment can hardly be considered satisfactory when there is a loss of 25 per cent. in drawing an empty canal-boat; but the chief objection is that the difficulty of steam traction for canals is not fairly stated. That the waves created by the propelling surfaces injure the banks, when the screw is used, is simply untrue. The injury to the banks is caused by the increased speed of the vessels, which, in a narrow canal, lowers the water when each boat is passing about eighteen inches, and the sudden return of this does the injury complained of. When the speed is less than four miles an hour it is not observable, but beyond this the injurious effect is very apparent, without any perceptible wave from the action of the screw.

Some years since an experiment was made on the canal between Wigan and Liverpool, in the presence of several of the directors of the canal and large coal-owners who wished to economise the carriage of coals. A long, narrow screw-steamer was employed, and it drew a long train of laden coal-barges, diminishing the number at intervals. It was found that, whilst the amount of load made comparatively little difference in the power of traction, the injury to the banks was solely caused by the rate of speed, which it was not safe to increase beyond a horse's walk. Nothing, therefore, was to be gained in speed, and even if the employment of a steam-tug to draw a long train of barges were less costly than the employment of horses, there still remained the difficulty of passing the locks, which would prove so serious a diminution from the saving on level water that the attempt was abandoned.

There is nothing in the account of the experiments on the Bridgewater Canal which shows that either of the difficulties I have alluded to has been overcome, or even so great an advantage gained as that by the screw-steamer.—I am, &c., BARNETT BLAKE.

Leeds, Oct. 11, 1859.

SAWDUST AND CRACKED BELLS.

Sir,—In the *Journal* of Sept. 9th, Mr. J. W. Carlile calls attention to the large quantity of sawdust and wood-cuttings wasted or burned without effective purpose.

This is an important subject, when we consider the enormous heaps of sawdust found near timber-works, in Europe and America, the danger from fire if they are left near the mills, the expense of carting them to a distance, the valuable space they occupy, the destruction of fish caused by casting the sawdust into the rivers, and the trouble of burning this material to avoid these disadvantages.

I was much struck with this when passing through Sweden last week; and it occurs to me that it may be well to mention that I saw a boiler-furnace burning crude sawdust, entirely unprepared and unmixed, in successful operation last summer, at St. John's, New Brunswick. I do not recollect exactly the construction of this furnace, but I think that Mr. J. Robinson, the proprietor of the extensive saw-mills where it is used, would gladly send a description to any person who may apply for it.

In the matter of the broken bell at Westminster, perhaps we might possibly learn from the Russians what is to be done in making a better job of the next casting. Every person knows how celebrated Russia is for the size, the tone, and the numbers of its church bells. Some weeks ago I was at Kimra, a small town on the Volga, in the centre of Russia. Part of the church tower had been lately consumed by fire, and the bell had fallen from a height of 50 feet, and embedded its edge about two feet in the stone pavement below.

This bell weighs more than 16 tons, that is, it is two tons heavier than the Westminster bell, yet it survived this fall, and is still sound, without even a crack. Let us bring this bell to London, and let it toll the time until the clockmakers settle their squabbles, and a better Big Ben is cast. I am, &c.,
J. MACGREGOR.

Temple.

CARBON GAS FIRE.

Sir,—Several patents have been taken out for gas fires in open grates, the patent being for the material used, such as "pumice," "asbestos," the material called the "polytechnic fire," "lump asbestos," and other materials, the use of which is very limited in consequence of the expense. The "lump asbestos" is valued at a guinea a pound, and the "polytechnic fire" material, although not so expensive in itself, requires more gas to get up a red heat; it also becomes very brittle by use, so that when taken out of the grate to clean the gas pipes—the holes requiring broaching occasionally—it breaks in pieces, destroying the effect intended. Finding this to be the case, and yet anxious to introduce gas fires, I have been trying experiments with material of various kinds, and have succeeded in producing a gas fire, superior, I believe, to any yet introduced. I have taken out no patent for it, that all gas companies whose interest it is to introduce gas fires to the public may do so at the cheapest possible rate. The material I find best suited for use is the carbon removed by the process called scruffing, from gas retorts; it should be broken up in lumps of about 2½ or 3 inches, and piled in the grate by hand, not thrown on in a mass. I find this material absorbs the gas, and causes a perfect combustion, making an excellent fire and throwing out a great heat, with a less consumption of gas than any other material. Gas companies can sell the carbon at 2s. 6d. per bushel ready broken, so that the cost of material will be trifling—one bushel lasting from three to six months, according to the heat required.—I am, &c., MAGNUS OHREN.

Gas Works, Sydenham, September, 1859.

Proceedings of Institutions.

Halifax Mechanics' Institution.—On Saturday evening, the 15th October, a soirée was held in connection with the Halifax Mechanics' Institution, on the occasion of distributing the prizes awarded to its members by the Society of Arts. The Chair was taken by the Right Hon. Lord Brougham, who was accompanied by the Earl of Shaftesbury, the Hon. A. Kinnaird, Mr. Frank Crossley, M.P., Mr. Edward Baines, M.P., the Mayor, Mr. J. S. Walsh, Archdeacon Musgrave, Mr. John Whitworth, president of the Institution, Mr. John Crossley, Mr. Joseph Crossley, Mr. James Stansfeld, Mr. W. H. Ripley (Bradford), Mr. S. Smith (Bradford), Mr. S. Waterhouse, Mr. Rankin, Mr. James Bowman, Professor Pillans (Glasgow), Mr. C. W. Sikes, (Huddersfield), the originator of the Penny Savings Banks, &c. The Chairman called upon Mr. James Stansfeld, one of the vice-presidents, who presented a report of the present position of the Institution. The total number of members on the books, it stated, was 732, of whom 205 were subscribers under eighteen years of age, and 90 female subscribers. The younger members for the most part were receiving instruction in the class-room. The average attendance of the male pupils at the classes was 171, and of the female 56. For the younger portion of the members there was a library of 1,000 volumes, and for the general members one of 4,000 volumes. The directors of the Institution had not been able, in consequence of the financial position, to purchase new books, although they felt that these additions must be continually made if the interest in the library was to be sustained. Occasional lectures had been given during the year, but they have only been occasional, for at Halifax this mode of receiving instruction appeared to have ceased to be attractive. The report briefly mentioned the position of the other departments of the Institution, and especially referred to the extraordinary success of the Penny Savings Bank. This was only established in 1856, and at the present time there were upwards of 3,000 depositors with open accounts, the average deposits of each being 3s. 10¾d. per week. The results of the examination of those from the Institution who submitted themselves to the Society of Arts' Examination the committee regarded as evidence of the solid character of the instruction afforded. Although the prizes were few, they were of a high order, and the candidates from the Halifax Institute had always attained a high position at these examinations. In conclusion, the directors appealed to their friends to assist them in carrying on their work with increased vigour and efficiency.—The Chairman then rose to address the assembly, and was enthusiastically received. After the applause, his lordship said he hoped it would be quite unnecessary for him to express his high gratification at the reception which they had given him, and which indeed had been extended to him by his Yorkshire friends wherever he had gone; and continued by alluding to the intense pleasure he had derived from visiting the marvellous works of his friend Mr. Frank Crossley, and the beautiful park so munificently presented by that gentleman to Halifax. Anything more splendid, anything more beautiful, and, what was better than splendour or beauty, anything more useful for innocent relaxation and wholesome enjoyment, anything more perfectly adapted to its purpose, than that park, he had never seen; and he was sure that with such a park open to them, no one need envy any proprietor of land in the country his grounds and gardens. Going on from better to best, he had derived a still higher enjoyment and gratification on learning from the report of the success of their Institution; and upon one or two points he would say a few words. The first point which had given him gratification was the great number of the working classes who profited by the Institution, three-fifths of the members belonging to that body. That was not all; he found that lessons were given adapted to the circumstances of the people, and he particularly noticed that sewing was taught. There could not be a better thing than to teach girls sewing, not excluding other teaching, such as a little history and geography, and even a little French—but the great thing was to teach women first that by which they might be made good housewives, good mothers of families, good wives of working men, so that they might make the working man's home more comfortable than the alehouse. This training was too much neglected in all institutions of this kind, and he had often complained of it, but that which was done here set an example to other places. He had been gratified to find that three-fifths of their members were working men, but he did not think that 700 or 800 was a sufficient number from the population of Halifax. Without offering any word of complaint he was most anxious that there should be more, and he would take the liberty of repeating the advice he had given at Bradford, that they should appoint a committee of working men from the members of the Institution, to canvass their brethren to unite with them in this good work—great and good for themselves, great and good for society, because society benefited by whatever benefited the individual—but he would have them to prosecute this canvass chiefly on the ground that it would be for their own personal advantage if they became members of the Institution. The thing, however, which above all had gratified him was the reference to Penny Savings Banks. There could not be a more useful institution. What they did was not so much to teach people providence as to encourage habits of providence, and he thought that 3,000 depositors was a very large number in proportion to a population of 40,000. His lordship concluded by thanking them for the patience with which they had heard him.—Mr. E. Baines, M.P., on rising to submit the first sentiment, referred to the admirable adaptation of their building for the purposes of a Mechanics' Institution, told them of what was being done by the Society of Arts, and directed their attention to the Yorkshire Union, hinting that that Union might shortly pay them a visit, and urging them to fill their class-rooms with pupils. They had heard from the report that lectures had ceased to be attractive in Halifax. Now he ventured to say to the committee that though lectures had for a time ceased to be attractive, they might become attractive again. Lectures had a value. They might be relied upon too much, and there were, no doubt, institutions which had drawn the most distinguished persons from all parts of the country, until the audiences had become satiated; but whether this was the case here or not, he ventured to predict that a series of good lectures would undoubtedly draw respectable audiences. It was at a lecture, given by Dr. Birkbeck in 1824, at which Lord Brougham was present, that he first received his knowledge of Mechanics' Institutions, his sense of their value, and his firm determination to do all he could to promote them. He was exceedingly glad to find that not only were their class-rooms finished, but that they were well filled. Classes were the oldest as well as the newest feature of these institutions,—for Dr. Birkbeck taught a class of working men in Glasgow twenty years before the lecture he had referred to,—and they were also the most important. The sentiment he had to submit to the meeting was "Mechanics' Institutions, in connection with Popular Education." He was sure he should have the concurrence of the noble chairman in saying that the classes—where they had systematic instruction and persevering mental application—were the most important part of a Mechanics' Institution in their relation to popular education.—The PRESIDENT then proceeded to deliver the prizes and certificates awarded by the Society of Arts.—The Earl of SHAFTESBURY received a most cordial and enthusiastic welcome. After mentioning his visit to Halifax two years ago, on the occasion of the opening of the People's Park, and referring in terms of eulogy and admiration to the great munificence and generosity of Mr. F. Crossley, his lordship remarked that wherever he went in Yorkshire he found Mechanics' Institutions in great abundance and in very great prosperity, and he rejoiced in this prosperity, because its results were so beneficial. He would plead guilty to having, some years ago—before he was aware of the necessity and operation of such institutions—of the principles which governed them and the objects to which they were directed—looked at them with the greatest possible alarm. The longer he lived, however, and the more conversant he became with the working and objects of these institutes, the more convinced was he of their absolute necessity as great means of education —for maintaining education already acquired, and for acquiring it when not obtained in early years. He said, therefore, "God speed Mechanics' Institutions." He was pleased to hear the practical character of the report read at an early period of the meeting. He was glad to see that they had formed a class for women, which, he believed, was peculiar to that Institution. It was a matter of vital importance that more attention should be paid to the education of females, which had been lamentably overlooked. In addition to sewing, he saw no reason why they should not be taught knitting, cooking, washing, and everything which would make a good wife. Thus, the home of the working man would be rendered peaceful, comfortable, and attractive. With reference to penny banks, he regarded them as the great discovery of modern times, judging by the effects they produced on the habits and morals of large masses of mankind. His lordship then referred to the great gratification which he had received from his visit to Yorkshire, especially in observing the mutual feeling of confidence and respect which existed between all classes. Often and often, when engaged in the effort to secure the reduction of the hours of factory labour, he had heard the people in Lancashire and Yorkshire say, that if that question were once settled they would never again give any annoyance to the Government. They never had, and he would undertake to say that in no part of her Majesty's dominions were there so much security, so much peace, so much safety, so much loyalty, and so much good affection to the Government under which they lived, as in the great counties of York and Lancaster. It was a source of unfeigned delight to see the mutual good relations between employer and employed, and to hear their reciprocity of kindness. When he went amongst the operatives, he was delighted to hear their kind expressions towards those by whom they were employed,—when he went amongst the masters he was equally delighted with their feelings towards the men; and all agreed that the adoption of the measure to which he had previously referred had done great good to the men and had done no harm whatever to the masters. This was a state of things in which every Englishman should rejoice, and in which every patriot must feel assured. They were told that "a nation divided against itself cannot stand;" but let them also equally believe that other truth, that a people of one and the same heart, by the blessing of God, shall never fall.—Mr. JOHN WHITWORTH then made a statement of the financial position of the Institution, with the view of suggesting a plan for extinguishing the debt. The erection of the hall of the Institute, with interest, had cost something like £8,700. There still remained a debt upon the building fund, with accumulated interest, £1,700.—Mr. F. CROSSLEY, on rising, was loudly cheered. The two noble lords, he said, had spoken of him in a far too flattering manner, but he felt that they had not uttered merely empty compliment, and he thanked them from the bottom of his heart. He then referred to the efforts of Lord Brougham for the abolition of slavery, and other philanthropic objects. Passing to the subject of the Institution, he said that all who were willing might there receive a good English education. Its doors were open and accessible to all, and those who availed themselves of these advantages were the men who would succeed in after life, for they might depend upon it that employers had their eyes open, and were looking out for the most intelligent and best instructed of their workmen to place them in positions of trust and responsibility. Where were they to find them, except amongst youths such as those who had received the rewards that evening. Lord Brougham had said the other night that thinkers must govern workers. So it must be, and it was very well for those who worked that there were thinkers who directed their sinews, and it was necessary for thinkers that they should have workers to carry out their thoughts and give them practical effect. The hon. gentleman then referred to the debt upon the Institution, and the necessity for its liquidation. When an effort to extinguish the debt was previously made, he promised £500 on condition that it was paid off in 1861, and two of his brothers each promised a similar sum. The panic, however, which set in in 1857, prevented the total extinction of the debt, but such was his anxiety that this consummation should be attained, that he was disposed to increase the £500 to £800, provided the debt was paid off by the time originally fixed. In conclusion, Mr. Crossley gave "Success to the Social Science Association."—The Hon. A. KINNAIRD, in supporting the proposition, referred to the important objects which the Social Science Association sought to accomplish.—Mr. RIPLEY having briefly returned thanks on behalf of the Asoociation, Messrs. JOHN and JOSEPH CROSSLEY expressed their intention of following the example of Mr. F. Crossley, by adding £300 each to their original contributions.—Subscriptions were then handed in from various parts of the room, the total sum contributed being £1,570. In addition to the sums already mentioned, Mr. John Whitworth subscribed £200, Sir C. Wood, £100; Mr. Jas. Stansfield, £40; Mr. J. Stansfeld, jun., M.P., £20; Mr. H. W. Ripley, £25; and Mr. J. J. Coleman, £3, the amount which had been awarded to him as a prize.—Mr. PHILBRICK moved a vote of thanks to the ladies, who had presided at tea, and the resolution was carried by acclamation.—Mr. JOHN CROSSLEY proposed, and Mr. STANSFIELD seconded, a vote of thanks to Lord Brougham, the Earl of Shaftesbury, and the other distinguished visitors who had attended the meeting.—The motion having been carried amidst loud cheering, Lord BROUGHAM returned thanks, and referred to his long connection with Yorkshire, which he dated from the year 1808, when he represented several Yorkshire towns, as their counsel, in their endeavour to get rid of the Orders in Council. The meeting then separated.

HALIFAX.—(HALEY-HILL WORKING MAN'S COLLEGE.) The distribution of the certificates gained by the students at the last examination of the Society of Arts, took place on Tuesday evening, October 11th, in the large school-room, Haley-hill, on which occasion there was a very numerous and respectable audience. The chair was taken by Mr. E. AKROYD, Principal; and amongst those present were Mr. T. S. Walsh, Mayor, Vice-Chancellor Sir W. Page Wood, the Right Hon. C. B. Adderley, M.P., Sir J. K. Shuttleworth, Bart., Sir

Thomas Phillips, Chairman of the Council of the Society of Arts; Major Edwards, M.P., Professor Pillans, Glasgow; Mr. J. Waterhouse, Mr. T. D. Ackland, Suffolk; Mr. Charles Ratcliff, Birmingham; Rev. J. H. Gooch, Rev. W. H. Wawn, Mr. W. Atkinson, &c. The choir of All Souls' Church were in attendance, and sang some pieces during the evening.—The Chairman said they were invited to take part in and witness the interesting proceedings connected with the distribution of the certificates of merit from the Society of Arts, to the successful competitors amongst the students of the Haley-hill Working Man's College. Amongst those invited to be present on that occasion were several distinguished guests, some of whom would address them on the subject of education. Those distinguished guests had done him and them the honour of being present, had a world-wide fame for their efforts in advancing the progress of education, and had shown, by deeds as well as words, the interest they took in promoting the welfare of the working classes. He was particularly anxious that those gentlemen should be with them on that occasion, because, as he would venture to say, that Institution was what it professed to be—a college of working men; and much to their honour it was that those men, who, after spending many hours in daily toil, should, when night approached, instead of indulging in sensual and debasing enjoyments, exercise their faculties and energies in opening new fields of knowledge, and devote themselves, heart and soul, to the work of raising themselves in the scale of civilisation and of society. They commenced education where the factory system let it off, and he ventured to say that one cause of the great success of Mechanics' Institutions in Yorkshire and Lancashire was, that the superstructure was based on the education provided by the Factory Act. When they dealt with those who had mastered the rudiments of education, they could advance much beyond what could be accomplished in other parts of the country. Hence, the success of Mechanics' Institutions in Yorkshire and Lancashire and their failure in London and elsewhere. The certificates of the Society of Arts had a general value, not like "penny tokens" which only passed current in particular neighbourhoods, but were like the coin of the realm; and wherever any student presented one of those certificates he would find they bore a general value, and that intelligent employers would give the preference to young men with such testimonies of their qualifications. It was evident, therefore, that the Society of Arts was conferring great benefits on the community by directing its attention to this matter—combining central control and examination with local management. They had thereby, what seemed to him a perfect machinery for advancing the progress of education, and promoting the interests of those who obtained certificates of general value throughout the kingdom. He might mention one instance of this in the fact that one of the collegians who obtained a certificate in chemistry had recently got a situation in the north of England with a handsome salary, simply from the circumstance of having gained that certificate. He had now the pleasing duty of presenting certificates to the successful students of the college, fourteen in number, who had gained them in one year, and as the principal of the college, he tendered those students his hearty thanks for their meritorious conduct, showing as it did that his endeavours to promote the prosperity of the Institution had not been in vain, and that whilst they had improved themselves, they had increased the credit and character of the college. The Principal then distributed the certificates to the successful students.—The Rev. J. H. Gooch moved the first resolution:—"That this meeting desires to express its entire confidence in the manner in which the examinations of the Society of Arts are conducted, and to express the hope that all Institutions professing to aid adult education of the people will, by means of Local Boards, avail themselves of the great advantages resulting from such examinations."—Mr. Charles Ratcliff, Birmingham, briefly seconded the motion, observing that from the little knowledge he had of the way in which the examinations of the Society of Arts were conducted, he was persuaded that in this, and all districts where the Society exercised its influence, it would be followed with the best effects.—Sir Thomas Phillips, chairman of the Council of the Society of Arts, next addressed the meeting, and after acknowledging the resolution just passed, observed that some might ask what direct connection the Society of Arts had with Mechanics' Institutions and the system of adult education throughout the land. Most of them were aware that the Society of Arts was instituted for the encouragement of Arts, Manufactures, and Commerce, and it had come to the conclusion that one important means of promoting arts, manufactures, and commerce was by the education of the working-classes of the country. For many years an endeavour had been made, by means of adult instruction in Mechanics' Institutions and Working Men's Colleges, to assist those desirous of improving their education; but those efforts were very desultory, and wanted that systematic character which would give value to their studies. What was wanted was to give students some object which would stimulate them, and cause them to manifest the qualities they possessed for engaging in the duties of active life, and the system now introduced was gradually established. The elevation of the working classes was to him an object of deep interest. By elevation of the working classes he meant far less a change of their condition than that moral standard of conduct, the restraint and self-government which might be learned in the progress of study at the college, and which it was well calculated to insure. Elevation of character was not dependent upon condition of life, but was to be found in the cottages of the poor as well as in the mansions of the rich. He did not undervalue the struggle to improve the condition of life, but with the struggle to rise and advance, unless there were that moral elevation of character, that self-respect, that recognition of duty to their neighbours and themselves,—unless those qualities went hand in hand with the intellectual culture, the intellectual culture itself would be in great danger, for it was a power which might be productive of evil as well as good. He had great confidence in lads who worked by day and studied by night, and who sacrificed present gratification for the sake of future well-being. He could not help expressing a wish to those who got rewards not to become proud, and that those who failed might be equal to the deserts of those who succeeded. It was a valuable distinction to receive the rewards, and he hoped they would prove a stimulus to future exertions.—Vice-Chancellor Sir W. Page Wood said he felt some embarrassment in addressing them, but he was one of those who took a deep interest in such meetings as that, and the objects they had in view. They did not meet to speak words of flattery; but he honestly stated that he had long wished to see Mr. Akroyd and the working of the system he had adopted with such success; and it was very gratifying to him to witness, not only such an appreciation of his labours, but the results which, with that gentleman's assistance and co-operation, they had produced. That they might continue those exertions to their life's-end was his earnest wish. He had great faith in examinations, without which they could not test the fruits of education. He had to tell them of the failure of a Mechanics' Institution in a district of London. For eighteen years they had endeavoured to protract its existence, and the great reason of its failure was that they had no means of stimulating its members to active exertion by means of those examinations which had been carried on through the operations of the Society of Arts. After struggling for eighteen years in vain to carry on that Institution, they were obliged to give up all their exertions; and the only comfort was that it led to success in another step, that of establishing a free library under Mr. Ewart's act, and that was the only free library established in the metropolis. Let them not forget that all they had done at present was merely the means towards an end—that their end was the advancement of their condition, not merely as regarded pecuniary or social advancement in the ordinary sense of the term, which he did not despise, for he had been a hard-working man all through life—but he recommended them to regard these as means to a great end, not merely that of improving their intellectual but moral being; not only of their knowledge of duty to their fellow men, but of an acquaintance not only in word but in deed, with the duties they owed to their Creator.—Sir J. K. Shuttleworth moved the next resolution, "That working men's colleges and mechanics' institutions are insufficient, in an educational point of view, unless they have connected with them a complete system of class instruction for young men and women, conducted by qualified teachers." He observed that ever since he became acquainted with the college established in Halifax, he had pleasure in recognising in it an example which ought to be influential in a great part of Yorkshire, and which had been in a great part of Lancashire, with respect to class instruction. The system of Mechanics' Institutions with regard to instruction by high scientific lectures had failed. The speaker then enlarged on the importance of systematic teaching, and concluded by saying that he regarded these Institutions as a means of solving some of the great difficulties which beset our complicated system. He believed that everything they had done for the enlightenment of the masses, would increase the security of property, and that every day as the working men increased in intelligence they drew the relations of labour to capital closer and closer. Mr. T. D. Acland, Vice President of the Society of Arts, seconded the motion, and referred to the necessity of educational efforts on behalf of those connected with agriculture.—The Right Hon. C. B. Adderley, M.P., moved the following resolution:—"That Institutions, formed on the plan of Working Men's Colleges, embracing library, reading-room, news-room, recreation-ground, and other means of social amusement, as well as a regular system of class instruction bearing on the occupations and handicraft trades of the students, are deserving of the confidence and support of the working classes." He came there chiefly to study the Institutions with which this part of England was so honourably distinguished. He came to learn, and he should certainly carry away more information than he brought with him. He had had to do with questions like that of the Reform Bill, and the great difficulty was to find a moral qualification, but no such qualification could be found. But in this Institution was to be found the test of the moral character of every one belonging to it. He could only wish them every possible success in that spirit of self-reliance in which they were carrying out their Institution, for he saw in the report that the students had a direct voice in the management of the college. That was the true spirit; let them not look for government patronage, though government might help them with training masters; he was more pleased to see the prizes offered by the Society of Arts than by the minister of state.—Mr. G. H. Bohn briefly seconded the resolution.—The Mayor having taken the chair, proposed a vote of thanks to Mr. Akroyd. Major Edwards, M.P., seconded the motion, which was carried by acclamation.—Mr. Akroyd then acknowledged the compliment, and the meeting separated after singing the National Anthem.

MEETINGS FOR THE ENSUING WEEK.

Wed. ......Geological, 8. 1. Rev. W. S. Symonds, "On the Passage-beds between the Upper Silurian into the Old Red Sandstone, at Ledbury, Herefordshire." 2. Mr. Henry Weekes, "On the Coal Formation, at Auckland, New Zealand." 3. Mr. W. Banerman, "On the Geology of Vanconver's Island."

Thurs. ...Chemical, 8. Prof. Bloxam, "On Crystalline Hydrates of Baryta and Strontia."

PATENT LAW AMENDMENT ACT.

Application for Patents and Protection Allowed.

[*From Gazette, October* 21*st*, 1859.]

Dated 30*th August*, 1859.

1973. T. Eastman, Southsea, Hants—Imp. in screw propellers. (A com.)

Dated 1*st October*, 1859.

2225. S. Ward, 8, Stanley-place, Stanley-street, Pimlico—An apparatus to be used in the hardening of saws and steel plates generally.

2227. C. Brown, Warwick-street, Pimlico—Imp. in inkstands and date indicator.

Dated 4*th October*, 1859.

2249. J. Rawlings, Carlton-hill East, Middlesex—An improved construction of boot-tree.

Dated 6*th October*, 1859.

2271. G. A. Smith, Old Cavendish street, Middlesex—Imp. in shot and shells, and other projectiles.

2273. W. Hopkins, Birmingham—A new or improved steam engine.

2275. G. Freeman and J. Royle, Unsworth, near Bury, Lancashire—Imp. in looms.

2277. W. Macfarlane, Glasgow—Imp. in machinery or apparatus for drawing off or discharging liquids, and in fountains, baths, and similar receptacles for liquids.

2279. W. Benson, Fourstones, near Hexham, Northumberland—Imp. in projectiles for muzzle loading rifled ordnance.

2281. W. Barron, Elveston, Derbyshire—Imp. in boilers applicable to heating and steam generating purposes.

2283. W. E. Newton, 66, Chancery lane—Imp. in the construction and manufacture of casks, barrels, and such like vessels, and in the machinery or apparatus to be employed for such manufacture. (A com.)

Dated 7*th October*, 1859.

2285. G. L. Lee, 49, Holborn-hill—Imp. in producing printing surfaces.

2287. G. P. Dodge, 44, St. Paul's Churchyard—Imp. in apparatus for preserving life, applicable to garments. (A com.)

2289. D. McCallum, Plymouth—Imp. in electric telegraphs.

Dated 8*th October*, 1859.

2291. W. Irlam, Newton Heath, Manchester—Imp. in the construction of railway turntables and cranes.

2293. J. Brough, Birmingham—An improved waterproof dress for protecting and saving life at sea or in other situations where a waterproof dress may be required, as also in the apparatus to be attached to or used with the same, for assisting the wearer to hoist or make signals, by night or by day, and to inflate, propel, and guide or direct himself as desired, the waterproofing principle of which being also applicable to other useful purposes.

2295. J. Childs, Windsor-house, Putney, Surrey—Imp. in the manufacture of artificial gums.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, October* 21*st*, 1859.]

October 19*th*.

994. J. M. Johnson and E. Johnson.
1002. J. Napier.
1005. D. Auld.
1007. E. Lewthwaite and G. Ambler.
1010. T. S. Truss.
1018. J. Angus.
1025. J. Marshall, junr.
1030. J. Higgin.
1044. W. Mackenzie.
1048. R. A. Brooman.
1055. H. R. Fanshawe.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October* 21*st*, 1859.]

October 17*th*.

2442. R. H. Collyer, M.D.

October 18*th*.

2462. H. Deacon.

October 19*th*.

2474. G. Thomson.
2476. W. E. Newton.
2504. L. A. Mangin.

[*From Gazette, October* 25*th*, 1859.]

October 21*st*.

2480. G. Ermen.

Patent on which the Stamp Duty of £100 has been paid.

[*From Gazette, October* 21*st*, 1859.]

October 17*th*.

450. G. Heyes.
464. J. Gilbert and S. Nye.

October 18*th*.

725. J. F. Belleville.

[*From Gazette, October* 25*th*, 1859.]

October 21*st*.

655. R. B. Cousens.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 4, 1859.

OPENING OF THE ONE HUNDRED AND SIXTH SESSION.

The first Ordinary Meeting of the Session will take place on Wednesday evening, the 16th inst., when Sir Thomas Phillips, F.G.S., Chairman of the Council, will deliver the introductory address.

EXAMINATIONS.

Dr. Lindley, F.R.S., Professor of Botany in University College, London, has been appointed by the Council Examiner in Botany to the Society of Arts.

BRITISH ASSOCIATION, ABERDEEN, 1859.

ON A NEW MODE OF BREAD-MAKING, BY WM. ODLING, M.B., F.R.S.

The following paper was read before the Chemical Section:—

I wish to introduce to the notice of this Section of the Association a new mode of making bread, invented by Dr. Dauglish, and now practised on a somewhat large scale in London. The process is one of considerable interest, not only in a chemical, but in a manufacturing and a sanitary point of view.

The vesicular character of ordinary bread, results, as is well known, from the development of carbonic acid gas uniformly throughout a mass of fermenting dough, whereby a loose, spongy texture is imparted to what would otherwise be a dense sodden lump of baked flour and water.

In fermented bread, the carbonic acid gas thus generated within the substance of the dough, is a product of the transformation, or degradation of one of the constituents of the flour, namely, of the starch or sugar. In the plan I am about to describe, the carbonic acid gas is produced independently and super-added to the flour, which consequently need not undergo any degradation whatever.

The following description furnishes a general outline of the process: Carbonic acid gas, stored in an ordinary gas-holder, is pumped therefrom into a cylindrical vessel of water, whereby the water becomes charged with the gas. This carbonic acid water is mixed, under pressure, with the flour, and the resulting dough, which becomes vesicular on the removal of the pressure, divided into loaves and baked.

At present, the carbonic acid gas is produced in the manner usually employed by soda-water makers. A mixture of chalk and water is run into a large wooden tub, in which an agitator constantly revolves by means of an endless band, driven by a steam engine. Sulphuric acid, flowing through a leaden pipe, closed at the bottom by a leaden cup of acid, which acts as a valve, is constantly dropping, by the overflow of the cup, into the mixture of chalk and water; and the carbonic acid gas thus generated passes at once into an ordinary gas-holder having a capacity of 1,000 cubic feet, where it is stored for use. But a different mode of producing the carbonic acid has been tried with success, and is now about to be employed. This process consists in the ignition of chalk, and is interesting as being opposed to our ordinary chemical notions of the circumstances under which chalk can be made to part with its carbonic acid. The chalk is heated for three or four hours in five small iron retorts resembling gas retorts. The first portion of gas, being constituted largely of air and steam, is allowed to escape; the remainder passes at once into the gas-holder. By this means a large supply of pure carbonic acid is obtained very cheaply. The lime remaining in the retorts, though not absolutely caustic, is very nearly so, and slacks readily with water.

From the gas-holder, the carbonic acid gas is usually pumped direct into the water-vessel, but sometimes into a separate reservoir of condensed gas, which then enters the water-vessel by its own elasticity. The pair of pumps are arranged to work under a pressure of 200lb. on the square inch. Any additional pressure opens a valve through which the gas re-passes into the gas-holder. The pumps are worked in a cistern of water, and the pipes leading from the pumps are encased in a sort of Liebig's condensing apparatus, whereby the great heat generated by the condensation of the gas is effectually withdrawn.

The water-vessel is a closed cylinder of copper, with hemispherical ends, tinned on the inside, about five feet high, and a foot in diameter. Its upper extremity communicates, by means of a cock, with a cistern of water placed directly above it, and, by means of another cock, with a pipe leading into the upper part of the mixing or doughing-vessel. This mixer is a hollow sphere of cast-iron, about three feet in diameter, having a rotating horizontal axis, to which the mixing arms or forks are attached. Its upper part communicates, by a pipe, with the upper part of the water-cylinder, and its lower part, by another pipe, with the lower part of the cylinder. It is furnished with two circular openings, somewhat less than a foot in diameter, one at top, one at bottom. The lids which close these openings of the mixer have each a circular rim or projection fitting into a corresponding circular groove or depression, lined with vulcanite; and the apposition is rendered pressure-tight by means of a screw. The exact mode in which these lids are adapted varies somewhat in the different mixers.

In order to make bread, a definite quantity of water —about 20 gallons—is run into the water-cylinder, so as to about three-parts fill it, the quantity admitted being read off upon a lateral guage. The bottom lid of the mixer having been properly attached, the cloth nozzle of a shoot is introduced into the upper opening, through which a sack of flour and three or four pounds of salt are passed, from an upper story, into the mixer. The cloth nozzle is then removed, and the upper lid properly closed. The closed mixer being then in communication with the closed water-vessel by the upper pipe, an exhausting pump connected directly with the mixer is set to work, and so rapidly and completely is the exhaustion of air from the interior of these two vessels effected, that in the course of two minutes a vacuum of 29 or 30 inches is produced. The object of this preliminary exhaustion is simply to prevent any admixture of air with the carbonic acid subsequently introduced, inasmuch as a great portion of this latter has to be used over and over again. The necessary vacuum having been obtained, carbonic acid gas is admitted, either directly from the forcing pump, or from the intermediate reservoir of condensed gas. The carbonic acid first enters the cylinder at the bottom of the contained column of water, passes through the water to the top of the cylinder, and thence into the mixer, an arrangement which promotes the thorough saturation of the water. Moreover, the gas is admitted through a rose furnished with a few minute openings only, whereby it does not pass through the water in mass, but is distributed equably throughout. The pumps are continued in action until the pressure in the two vessels has reached 100 lbs. on the square inch. Then on turning a cock at the bottom of the cylinder, which is on a higher level than the top of the mixer, the water runs from the cylinder into the mixer by its own gravity. The kneading axis, with its arms, is next set going. The process of kneading differs from ordinary machine kneading in one important particular. The substance kneaded is not a tough vesicular mass of fermenting sponge and flour and water, difficult to incorporate, but a non-vesicular mass of flour and water only. This kneading is continued for a period varying from three to ten minutes. As a rule, the less the kneading of the flour, the whiter and more perfect the bread, but with some descriptions of flour the kneading must be continued for about ten minutes, in order to develop the elastic and tenacious characters of the gluten sufficiently to retain the carbonic acid, although with good flour, three or four minutes are generally sufficient. After the kneading is completed, the dough is forced out from the mixer by the elasticity of the contained carbonic acid.

The exit for the dough is of somewhat peculiar construction. In the bottom lid of the mixer, shielded by internal buttons to prevent the direct pressure of the gas, are two rectangular slits, each two inches long and a quarter of an inch wide. From these proceed two flat tin pipes, which gradually increase in size, trumpet-like, until they meet together, when they unite to form one circular nozzle, about 4 inches in diameter. The object of this contrivance is to prevent any sudden expansion of the dough as it becomes freed from the pressure in the mixer. Thus the section of dough, as it escapes from the mixer, occupies an area of one square inch only. It then passes through the gradually expanding trumpet pipe until its sectional area becomes equal to about 12 square inches, after which it is allowed to expand freely. The boy in charge of this exit for the dough has at his disposal a cut valve, by which the issue of the dough through the pipe is stopped or permitted. He receives the dough in a succession of tins or French moulding baskets and, by a little practice, is able to cut off from the continuous stream of dough, into each tin or basket, a quantity weighing about 2 lbs. 4 oz. The tins with the dough in them are placed at once on the floor of the oven. The dough in the baskets is emptied on to wooden peels and thence slid upon the oven bottom. This oven is what is termed a travelling oven. The bottom constitutes part of an endless chain revolving on two drums, by which the speed of its travelling can be regulated. The loaves enter at one extremity of the oven and are ejected at the other, being baked during their transit.

The advantages of the new process are,—1st. Its cleanliness. Instead of the dough being mixed with naked arms or feet, the bread, from the wetting of the flour to the completion of the baking, is not, and scarcely can be, touched by any one. 2nd. Its rapidity. An hour and a half serves for the entire conversion of a sack of flour into baked loaves; whereas in the ordinary process four or five hours are occupied in the formation of the sponge, and a further time in the kneading, raising, and baking of the dough. 3rd. Its preventing deterioration of the flour. In making fermented bread from certain varieties of flour, not in themselves unwholesome, the prolonged action of warmth and moisture induces a change of the starchy matter of the flour into dextrine, whereby the bread becomes sodden and dark-coloured. This change is usually prevented by the addition of alum, which is, indeed, an almost necessary ingredient in the manufacture of bread from glucogenic flour. But in operating by the new process, there is no time for the glucogenic change to take place, and consequently no advantage in the use of alum, even with any description of flour. 4th. Its certainty and uniformity. Owing to differences in the character and rapidity of the fermentation, dependent on variations of temperature, quality of yeast, &c., the manufacture of fermented bread frequently presents certain vagaries and irregularities from which the new process is entirely free. 5th. The character of the bread. Chemical analysis shews that the flour has undergone less deterioration in bread made by the new, than in that made by the fermented process. In other words, the percentage of extractive matters is smaller. The new bread has been tried dietetically at Guy's Hospital, and by many London physicians, and has been highly approved of. It is well-known that for some years past, the use of fermented bread, in dyspeptic cases, has been objected to by members of the medical profession, the débris of the yeast being considered unwholesome, and liable to induce acidity. 6th. Its economy. The cost of carbonic acid is alleged to be less than the cost of yeast. Moreover, in making fermented bread there is a small, but necessary waste, of the saccharine constituents, which is avoided in the new process. 7th. The saving of labour and health. It substitutes machine labour for manual labour of a very exhausting kind. The sanitary condition of journeymen bakers was investigated some time ago by Dr. Guy, and found to be most lamentable, from their constant night work, and from the fatiguing and unwholesome character of their labour, particularly the kneading. In a politico-economical point of view, the process is as important as removing bread-making from a domestic manual work to a manufacturing machine-work. From the character of the apparatus, the process can only be used profitably on a large scale, and not in small bakeries.

On Soluble Silicates, and some of their Applications.—By Frederick Ransome, A.C.E.

The following paper was communicated to the Chemical Section:—

So much interest has recently been expressed in reference to this subject, both in this kingdom as well as upon the Continent, and so much misconception has existed, that I have felt a few remarks thereon might not inappropriately be submitted for consideration and discussion upon the present occasion.

Amongst the early accounts that were published of the application of soluble silicates, I may mention a paper by Dr. Johann Fuchs, which appeared in Kastner's "Archiv for Natural Philosophy" in 1825, page 385, in which is described a combination of silica fused with potash or soda in such proportions as to produce a glass which was soluble in boiling water, but which was insoluble in water at the ordinary temperature of the atmosphere.

Important as this product has subsequently proved to be, in the various branches of manufacture in this and in other countries, it at first attracted but little attention, and for years afterwards remained little more than a recorded chemical fact, unconnected with any of those important practical applications which have subsequently attracted so much attention in the scientific world.

From publications which have recently appeared, it would seem that Dr. Fuchs' researches and experiments upon the application of soluble silicates were mainly directed to stereochromy and to the effects produced by their admixture with various substances, such as carbonate of lime, phosphate of lime, sulphate of lime, caustic lime, dolomite, quartz, clay, and oxide of zinc and magnesia; and although these researches extended over many years, yet but comparatively little was practically done or known outside of the laboratory at Munich until the year 1855, when shortly before his death, at the age of 82 years, this learned philosopher gave to the world the result of his valuable investigations and indefatigable labours.

The researches of Dr. Fuchs were followed by those of Professor Kuhlmann, at Lille, who it appears, as early as 1840, directed his attention to the combinations that were effected by the admixture of soluble silicates with lime, either carbonate, sulphate, or caustic, and the application of soluble silicates for the purpose of hardening and preserving the porous stone of monuments and building soon forced itself upon his mind.

The method of hardening stone, &c., adopted by Professor Kuhlmann, and described by him in a pamphlet published in 1857, is, in the case of small articles, to immerse them for some hours in a solution of silicate of potash or soda, of a suitable strength, to be freely absorbed into the stone; or in the case of larger surfaces, the dilute silicate is applied by means of "fire-engines or large syringes with broad rose-nozzles," or, in instances where more convenient, by means of small brushes; the operation is repeated as often as occasion may require, until the stone has ceased to aborb. In this manner several important buildings have been treated, amongst which may be mentioned portions of the Louvre and Notre Dame, in Paris, the Napoleon Barracks, and the Exchange at Lille, and other buildings, including a portion of the New Houses of Parliament in our own land.

The soluble silicates have also been employed to a considerable extent in many other branches of our manufactures, &c., such, for instance, as in calico-printing, in the manufacture of soap, in the dressing of stuffs, and in the preparation of paints; but as the details of these several processes would occupy a much larger amount of time for their consideration than would be convenient upon the present occasion, I purpose to direct my remarks more particularly to the application of soluble silicates to the manufacture of stone, and to the hardening and preservation of stone and other substances.

It was early in the year 1844 that my attention was first directed to some of the defects that existed in many of the natural stones, which tended greatly to detract from their value for purposes to which they were applied; and I felt the importance of producing, if possible, an artificial stone, suitable for grinding, building, and ornamental purposes, which should possess all the advantages, and be free from many of the defects complained of in the natural stones hitherto in use. I found that with few exceptions the hardest and most durable stones were those containing the largest proportion of silica; and after a series of experiments, in which I endeavoured to combine mechanically crystals of sand, &c., by the admixture of finely-powdered glass, forced into metal moulds, under hydraulic pressure, then, by exposure to heat, fusing the glass so as to form a vitreous cement enveloping the crystals of sand, &c., and after having also tested the combination with the most powerful hydraulic and other cements, it occurred to me that if in the place of the finely-powdered glass, or the other cementing matter, I could substitute concentrated solution of glass (silicate of soda and potash), a great desideratum would be arrived at. In order to obtain the soluble silicate, I suspended the ordinary flint stones, as found from the gravel or chalk pits of the neighbourhood, in wire baskets, inside a high pressure steam boiler charged with a strong caustic solution of soda or potash, and subjecting the same to a steam pressure of from 60 to 80 lbs. per square inch. At this temperature the alkali rapidly dissolves the silex until a sufficiently neutral silicate is produced, which is then removed and evaporated down to a sp. gr. of 1750.

The stone thus made and dried was found to be excessively hard, close and uniform in texture, and capable of being moulded into any desired form; but upon exposure to water or a moist atmosphere, it gradually became soft, and was easily disintegrated. To remove this difficulty, it was necessary to subject the stone to a bright red heat in a kiln, when the free alkali of the cementing silicate combined with an additional quantity of the silex of the sand, producing an insoluble silicate no longer affected by moisture or other atmospheric influences. By varying the proportions and strength of the soluble silicate, it will readily be understood that the density and texture of the stone produced may be varied almost indefinitely, or from that of the most open and porous stone suitable for filtering water and other liquids to stones of the hardest and closest texture, resembling granite. For a time the results appeared perfectly satisfactory, but when the stone came to be practically employed upon a large scale, and in exposed situations, the efflorescence of a salt was observable upon the surface of the stone, causing an unsightly appearance, and leading to apprehensions that disintegration would shortly follow. Upon investigation it was found that the salt thus exuding from the stone was sulphate of soda, which existed in the soda ash of commerce in part, and which was increased by the impurity of the lime used in rendering the solution caustic. This objection was at length removed by treating the caustic solution of soda with caustic baryta, before admitting it into the boiler with the flints.

From the small specimens herewith submitted, it will be seen that in the process of manufacture, this stone is capable of receiving the finest and sharpest impressions, and possesses all the characteristic appearances of the best natural sandstones; it is not liable to shrinkage or distortion under the operation of firing; it may be readily worked by the chisel, as other freestones, if required; and by a series of experiments recently made at the testing-house in her Majesty's dock yard, at Woolwich, it was proved that the power of resistance it offered to steady transverse strain was represented by 100, whilst that of

Darley Dale stone was		81
Of Grimshill-hill	,,	37
Of Portland stone	,,	33
Of Aubigny	,,	31
Of Bath	,,	13
Of Caen	,,	12

At the same time, blocks of this stone, 2 inches cube, sustained a crushing weight of 21 tons, whilst similar blocks of Darley Dale crushed with 16½ tons. These figures are the mean results of three experiments upon each of the stones alluded to, and furnish satisfactory evidence of the suitability of the material for purposes of construction; and, as far as experience as yet shown, it is in no way injuriously affected by the alternating influences of the atmosphere, even in the most exposed and unfavourable situations.

From the satisfactory results obtained in the manufacture of stone, by means of the soluble silicate, and observing, in several instances that came under my notice, that the stones so produced had stood uninjured for years under precisely the same circumstances that produced decomposition in natural building stones, I was led to consider how the soluble silicate could be applied to soft natural stones, so as to harden their surface and prevent decay, the principal cause of which, in many descriptions of stone at least, is now generally admitted to arise from the absorption of moisture, which, often containing acids, especially sulphuric and carbonic acid in solution, acts chemically on the stone, or produces disintegration by the alternate expansion and contraction caused by changing temperature.

The class of stones more generally used for construction, in ordinary cases, are limestones, whether oolitic or otherwise, magnesian limestones, and sandstones. These are all free stones, which are, for the most part, composed of grains, whether quartz, carbonate of lime, or carbonate of magnesia, cemented together generally with carbonate of lime; they vary considerably in hardness and relative weight, and generally those of densest character are the most desirable and the least absorbent. When these stones are exposed in the damp impure atmosphere of large manufacturing or populous towns, they, or their cementing media, are soon acted upon by the carbonic or sulphuric acid contained in the atmosphere, and held in solution in the rain water, which is readily absorbed within the natural crevices, or between the grains of the stone itself, and then, contracting or expanding with the variation of temperature, the surface of the stone becomes disintegrated, small scales are first thrown off, or, as is frequently the case, the surface assumes a loose powdery appearance from the destruction of the cementing medium, the general result being, that a process of decay commences, which is continued until the entire surface of the stone is destroyed, and the building is seriously disfigured. To remedy these evils many processes have been proposed, but as they been for the most part required the use of oily or fatty matters, which, besides producing a disagreeable appearance, are liable to rapid decomposition from the oxidising effects of the atmosphere, they have been found inadequate to the desired purpose. It appeared to me that, in order to impart hardness and durability to these soft and easily decomposable stones, it was necessary to effect a process which should not only externally close the pores against the absorption of deleterious agents, but that should also at the same time bind more firmly together the several atoms of which the stone was composed, and for this purpose I had recourse to the solutions of silicates of soda and potash. These I found, when applied upon stones in dry situations, produced an amazing increase of hardness, and which, so long as it was protected from moisture, appeared to be thoroughly effective; but in operating with these solutions upon a practical scale out of doors, I found that a shower of rain or even a humid state of the atmosphere at once removed the portion of the silicate next the surface of the stone before it had absorbed sufficient carbonic acid to precipitate the silica, and in order to avoid the liability to this objection, my next step was to apply a weak acidulated solution immediately after the silicate, which, by combining with the alkali, formed a chloride of sodium or chloride of potassium, leaving the silica free in the pores of the stone.

It, however, was soon evident that silica in the form of a gelatinous hydrate possessed no cohesive properties, and was therefore inadequate to impart much if any solidity to a crumbling mass, and I therefore directed my attention to find some other substance in solution which, by combining with the soluble silicate, would, by double decomposition, produce an insoluble, indestructible precipitate possessing the desired properties.

Silicate of lime has long been known to be one of the strongest cementing media with which we are acquainted, and is, practically speaking, indestructible by time and other external agencies. It is the substance that imparts the valuable properties to our best and strongest hydraulic cements, the formation of which insures the stability of our solid concrete masses, and which has conferred such enduring properties on the old Roman mortars. I therefore concluded that if it were possible to form silicate of lime in the structure of the stone (independently of any decomposition of the stone itself), so as completely to envelope the several atoms of which it is composed, I should succeed in producing a result which would at once materially increase its hardness, at the same hermetically closing all the pores, and be lasting in its effects. Chloride of calcium suggested itself to me as offering the advantages I had been seeking, and a few experiments were then sufficient to satisfy me that I was not mistaken. I first treated the stone or other material with a solution of silicate of soda, sufficiently diluted to be thoroughly absorbed into the mass, and afterwards with a solution of chloride of calcium. A chemical combination immediately takes place, the chlorine combining with the soda forms chloride of sodium (common salt), which is washed away by the first rains or by other application of water, and the calcium combining with the silicic acid of the silicate, forms a tough silicate of lime, attaching itself firmly round the surface of each separate grain of the stone with which it comes in contact, producing an extremely compact deposit, not acted upon either by carbonic or dilute sulphuric acid, and identical with the material which holds together the separate grains or stones in hydraulic cements and concretes.

I found also that by substituting a solution of chloride of magnesium for the chloride of calcium, that silicate of magnesia was produced in the same manner; but though, under some circumstances, and in treating certain materials, the silicate of magnesia may possess some advantages; yet, for general application, under ordinary conditions, the silicate of calcium will be found equally effective, whilst the cost of the materials will be less.

Accordingly, in the year 1856, I secured patents for the process throughout this kingdom and in France, and in the month of October in the same year I operated upon two of the buttresses upon the river-front of the New Houses of Parliament at Westminster, the stone of which was at that time in a rapid state of decomposition. Although this was the first application of the process that I had ever made outside the laboratory, the result has been eminently successful, and although nearly three years have passed since these portions were so treated, no indications of decay have since appeared, but, on the contrary, a small excess of silicate of lime which was inadvertently left upon the surface of the stone, through the carelessness and inexperience of the workman, is still present, and cannot even now be removed by any mechanical means, without, at the same time, destroying the face of the stone.

During the past three years, the efficiency of this process has been tested under every variety of circumstances that has been suggested, with the most satisfactory results. Masses of soft and easily decomposable stones have been treated over only portions of their surfaces, and afterwards exposed to the alternating influences of heat and cold, and wet and dry atmospheres. In no instance has decay since been visible upon any portions of the stones which had been properly treated, whilst, in almost every instance, the portions of the same stones not treated, have manifested, more or less, decay; and pieces of the same stone have been taken, some of which were treated by this process, and an equal number were left in their natural state; each was carefully dried and weighed, and then all were immersed together in a dilute solution of sulphuric acid for an equal length of time. Upon being removed from the acidulated solution, it was found that, in every instance, the stones that had not been treated by the preservative solutions were entirely broken up, falling into fragments, but that, without exception, every stone that had been so treated was entirely unacted upon, had retained all its sharpness of outline, and had not diminished a grain in weight.

The process herein described is equally applicable to bricks, cement, plaster, and even to common chalk; it renders these materials equally capable of resisting the varying and destructive influences of any climate, prevents all liability to dampness or vegetation, as also the absorption of smoke or dirt, which produces discolouration, so frequently disfiguring our finest edifices.

Many instances may be adduced as practical evidence in support of the foregoing remarks, but I need only further mention, that amongst other important buildings, this process has been applied upon the Baptist Chapel, in Bloomsbury-street, London; upon the Royal Pavilion at Brighton; the Custom-house at Greenock; and is now being used upon Craigends-house, near Paisley; and upon Lennox Castle, near Glasgow.

I regret that at this distance from home it has been impossible for me to submit larger specimens, and in greater variety, illustrative of the results obtained upon different substances under varying conditions, which I feel would have added interest to this communication, but I trust sufficient explanation has been given of the manner in which soluble silicates may be produced, and of some of the valuable purposes to which they may be applied, to justify my having intruded this paper upon your notice, and having occupied so much of the valuable time of this section of the Association.

UNSINKABLE SHIPS.

The following has been received from the Editor of the *Mechanics' Magazine*:—

The extraordinary changes which modern ordnance has undergone, and is still undergoing, have led to many curious suggestions, and among the most curious may be mentioned a scheme first propounded by Mr. Charles Atherton, of Woolwich Dockyard, in the *Times* of Jan. 12, and the *Mechanics' Magazine* of Jan. 14, 1859, and revived by him in a recent number of the *Journal of the Society of Arts*. Mr. Atherton's object in the first instance was to make gun-boats, mortar-boats, floating-batteries, &c., invulnerable; and he asks—Why not make them up to the lines of their load displacements "solid masses" of material, of such specific gravity that they shall not sink however much they may be perforated by shot? He considered that a solid combination might be made of cork shavings, light wood sawdust, rush stems, cotton waste, flock, hemp, and other light material, by the aid of a solution of gutta-percha, or other chemical substance. This mass might be made, he thought, so tough that it could not be knocked to pieces by shot, and so light that it would be only one-half the specific gravity of water, and therefore unsinkable, however perforated by shot, and also capable of carrying an armament and naval equipment to the extent of nearly one-half the weight of its own displacement in tons. "Such vessels of light draught accompanying fleets of war as tenders to line-of-battle ships, whence they might be manned and stored as occasion might require, would, I submit," said he, "form a useful auxiliary available for shore service, or for attacking land batteries, which deep draught ships of the line cannot approach, and would be sunk if they could." The idea was first broached by him two years before as being applicable to the construction of vessels for carrying treasure.

In the interval that elapsed between the dates of Mr. Atherton's letters his ideas appear to have expanded enormously. We no longer hear of unsinkable "tenders to line-of-battle ships" only; but ships of war of all classes are to be constructed on the unsinkable principle. "I have no doubt," says Mr. Atherton, "that at a moderate cost per ton of shipping, existing vessels may be rendered unsinkable, and that a new modification of ships of war of all classes may be devised, such as may obviate the horrors which appear to be otherwise inevitable in maritime warfare under the fire of modern ordnance." It ought to be stated that Mr. Atherton's reason for renewing his proposition at the present time, and in its enlarged form, is a belief of his (founded on a paragraph in the *Times*) to the effect that iron-cased ships will be incapable of resisting the fire of modern ordnance, and that, as recent events have shown, ships of the ordinary build may be sunk by the fire "even of an extemporised Chinese fort."

There is, of course, one great primary obstacle to the carrying out of Mr. Atherton's plan, namely, that no such material as he requires for his purpose is at present known. The singular compound mentioned in his first letter does not seem to satisfy him now, and he therefore proposes that £250 be subscribed and placed at the disposal of the Council of the Society of Arts, to be awarded in premiums of £150 and £100, "for the discovery and specification of the materials and process of manufacture most available for producing a combination of materials constituting a solidifying pulp possessing in the highest degree the properties of specific lightness, toughness, non-absorption of water, and cheapness, or a metallic cellular body having the same properties." But how a "metallic cellular body" is to answer the purpose we cannot conceive. It seems to us a very remarkable circumstance that Mr. Atherton loses sight altogether of the danger of fire, which is more likely to do injury than anything else, now that the use of shells is universal in naval warfare. His light buoyant material must be presumed to be exposed to the fire of ordnance, for its whole merit is to consist in being unsinkable when "perforated" by shot or shell; and, consequently, unless it were uninflammable as well as unsinkable, it would be of little use. Mere "lightness, toughness, non-absorption of water, and cheapness" alone will not therefore do. If we are wrong in this, we shall be glad if Mr. Atherton will show us where our error lies; but he must not forget that "liquid fire" is as veritable a means of offence as the Armstrong gun, and has proved its efficacy quite as decidedly. Of course we are aware that a solid substance would not be set fire to by the mere lodgment of a red-hot shot in it, with no other access for air save the hole by which the shot entered. But the explosion of powerful shells within such a substance would be a very different matter, and would, we think, in most cases, have the effect of setting it on fire. There can be no great harm in offering the premiums proposed by Mr. Atherton, if there is the least chance of obtaining a very light and waterproof solid material, because such a material would be useful for many purposes; we have no desire, therefore, to obstruct the action of the Society of Arts in this matter.

But, having said this, it remains for us to say further that even if such a material as we have spoken of should be produced, and placed in Mr. Atherton's hands, we should be disposed to ask wonderingly—"What will he do with it? and we think the Society of Arts should consider this question before they accept his advice respecting the premiums. With a ship solid below the water line where would he place the engines, coals, provisions, powder, and all those other stores which now are stowed in the lower parts of the ship? We know not how to conceive a plausible answer even to this question. Will Mr. Atherton kindly help us out of the difficulty? We hope he will, if possible, for his own credit's sake. It is easy enough for any man to make propositions in the form in which the present one comes before us; but it will not do for a gentleman who has taken a wrangler's degree at Cambridge, and made himself prominent in scientific discussions, to leave his proposition utterly undeveloped. It is, we think, incumbent upon Mr. Atherton to show us what the "new modification" of ships of war is to consist in, assuming that the material which he asks for is supplied. We should be heartily delighted to find that he has the design of the unsinkable war-ship in his mind. This, in our judgment, would be worth a very handsome "premium," and the Society of Arts would perhaps do well to offer one for it before they offer the others. They need not fear any very extensive competition. Of course it is quite possible to build enormous *rafts*, and call them by the new name of "unsinkable ships;" but these can hardly be what Mr. Atherton is thinking of, since he talks of rendering "existing vessels" unsinkable, and since he must know perfectly well that the time for abandoning real ships has not yet arrived. What, then, is he thinking off? We respectfully invite him to tell us.

IRON SHIP-BUILDING.

The following letter has been addressed to the editor of the *Times*:—

Sir,—Among the many and mighty inventions and adaptations which have contributed to make this country and this age famous, a conspicuous place must be given to the application of iron to shipbuilding. Without it England's mercantile marine could scarcely have kept pace with the marvellous growth of her commerce, and oceanic steam navigation would yet have been in its infancy. Even Brunel's genius would have quailed in attempting the construction of the Great Ship in any other material; and it is scarcely too much to say that the abundance and richness of the ferruginous ores which are found in this island, and the facilities for their reduction placed in our hands by nature, compelled our naval constructors to direct their attention to the use of manufactured iron in building vessels.

The iron ship, when well built, is indeed stronger, safer, and more durable than any other, and yet if we search the records of those disasters to which all seagoing ships are exposed it will be found that the most destructive and appalling have occurred in iron bottoms. I need only call to mind the wreck of the Birkenhead, which will find a place in history as the scene where the disciplined bravery and devotion of our soldiers were nowhere more conspicuously displayed, and that awful and heartrending catastrophe which within the last few days has carried sorrow and anguish into hundreds of homes. Yes, while the hearts of relatives are yet bleeding, and the public is stunned with the immensity and suddenness of its loss; while many would try to bury their grief in oblivion, and others would prefer to contemplate in silence such an illustration of the mysterious ends of Providence, I conceive that the lessons which the loss of the *Royal Charter* is calculated to afford ought not to be overlooked, and that the causes of a wreck so sudden and so complete should be most promptly and searchingly investigated.

I would, therefore, very earnestly and prominently bring under the notice of your readers certain general features and practices in the construction of iron vessels which in my opinion are in the last degree dangerous and reprehensible. It would seem to commend itself to the common sense of every man that in building an iron sailing or steamship which is to be subjected to all the strains and buffetings of tempest-tossed seas, which will be freighted with hundreds of human beings and the most precious cargoes, and which must run the risks of collisions and strandings, none other than the very best and strongest materials should be employed. The toughest iron, the best seasoned spars, and the stoutest planks and ropes should alone find places in such a venture. But in our ordinary every-day practice is this the case? Is not any kind of iron thought good enough to build a ship with? What is the meaning of "boat plates" being the lowest priced in any ironmaker's list? If we pay £25 or £30 a ton for the plates of which a locomotive boiler is made, why should we give only £8 10s. or £9 per ton for those of which a ship is built. If safety can only be bought at the high price in the one case, are we not courting disaster with the low price in the other? Who will draw the fine line of distinction in moral responsibility between the directors of a railway company who should take your fare, place you in a comfortable first-class carriage, and drive you at 40 miles an hour over a viaduct which was miserably insecure, and the owners of vessels who send passengers to sea in ships sheathed with plates which are as brittle as glass? The only answer to this question in the way of excuse is, I fear, that most men are really and truly ignorant of the facts. In the eyes of the merchant in London or Liverpool who orders the building of a ship, iron is iron. He probably does not know that in this material there are as many shades of quality as there are in the wines or fruits which all bear one common name, and yet I am within the mark when I say that he might, by paying £2 or £3 per ton increased price upon the plates forming the outward sheathing of his ship, immensely increase the vessel's strength and duration.

With good, well-worked plates, where the fibre of the iron is ductible and tenacious, and where these plates are well and judiciously fastened together, no vessel, even if wrecked in such a gale as that of last Tuesday, would break to pieces so suddenly and so utterly as the *Royal Charter* seems to have done.

But built of the "boat plates" of the present day, God help the human freight of the ship that strikes upon a rocky shore!

I would therefore advise shipowners when contracting for new vessels, instead of being satisfied with a specification which provides good ordinary "boat plates" to be used, and which are, in fact, about the most rubbishing quality of iron which is made, to insist that the sheathing should all be of best best, or double-worked quality. In a vessel of 1,000 tons it would not increase the cost £500, and the value is gained in the greater strength and durability of the ship, to say nothing of the lives that it may possibly save.

Further, I would caution all well-disposed shipowners to look with great suspicion upon the cheap offers which are constantly laid before them as temptations to order ships. To anyone conversant with a ship's value, what other construction can be put upon a contract for a vessel of 1,000 tons with the most expensive outfit for £13, or £13 10s., or even £14 per ton measurement ready for sea than that the builder means to employ bad materials and scamp his work? He begins upon such an order with a determination either to cheat his customer or cheat his creditors. But such vessels are built on the Clyde, the Tyne, and elsewhere, and I maintain that the ship-owner in buying them shares with the builder the moral responsibility of a great guiltiness, for they are deliberately launched and freighted to go to the bottom.

I am, Sir, your faithful servant,
AMICUS.

Manchester, Oct. 31.

CHAMBERS OF COMMERCE.

The following communications have been addressed to the Secretaries of the several Chambers of Commerce in the United Kingdom, by Mr. Leone Levi, Professor of Commercial Law at King's College, London:—

10, Farrar's-buildings, Temple, London, Oct. 26, 1859.

My dear Sir,—I have much pleasure in sending you my ordinary circular, which I trust you will deliver to the members of the Council. You will find in it a suggestion for a General Conference of Deputies from the Chambers of Commerce of all countries. Should you approve of the proposal, I shall be happy to give you further details of what could be undertaken by such a meeting. We would thereby open a direct correspondence and friendly intercourse with such Chambers. We would interest them in the promotion of such measures, whether legal or economical, as may best advance international commerce, and we would establish an interchange of information relative to the trade, produce, and manufactures of the different countries likely to prove permanently useful. I do not think it imperative to send the invitations to the Continental Chambers, which are supported by the State, through the Foreign Office, and it would, on the whole, be better that the entire arrangements would remain with the Chambers. The best opportunity for such a meeting is evidently the time when the next International Exhibition will be held, in 1861 or 1862. The Conferences already held between the Chambers of Commerce of the United Kingdom, have been productive of much benefit, both in suggesting and maturing several important measures of mercantile law, and in extending the influence and increasing the usefulness of the Chambers of Commerce. No attempt has as yet been made to bring together the Chambers of Commerce of Europe, America, India, and the British Colonies, though the need of such intercommunication has often been felt. I trust that the proposal may be responded to by all the Chambers in the United Kingdom, and that the happiest results may ensue from its realisation.

I remain, dear sir, your's very truly,
LEONE LEVI.

To the Secretary of the Chamber of Commerce of ———

10, Farrar's-buildings, Temple, London, Oct. 26, 1859.

My dear Sir,—The meeting of the Social Science Association has afforded an opportunity for discussing many questions affecting the commerce of the United Kingdom, and more especially those which are subject to legislative measures. To obtain, for any important purpose, the united action of the Chambers of Commerce, has always seemed to me a most desirable object to accomplish.

The questions of local bearing only, are but few as compared with those of national importance, and even where a locality only is primarily affected, directly or indirectly, the influence is felt throughout the country. The project has once more been made of obtaining the incorporation of all Chambers of Commerce, or charters of incorporation for each, with the usual privileges of chartered bodies. The benefits of such a measure would mainly consist in the status thereby conferred on these voluntary associations, and in the greater influence they would acquire in their respective localities. I would object to their receiving pecuniary support from the State, as that might be purchased at the cost of independence of action, and might also produce a loss of moral weight in any representation to the State and Parliament.

Now that the Chambers of Commerce have come to a common understanding with regard to the Bankruptcy Laws, it will be easier for Parliament to legislate on the subject; yet, we may well expect considerable discussion, and much opposition, and the success of the measure will entirely depend on the Solicitor-General undertaking it on behalf of Government. The expediency of obtaining an international right on trade marks—a question of great practical importance, especially to Sheffield, deserves the serious consideration of all the Chambers, inasmuch as the abuse of British marks by foreign manufacturers has the effect of lessening the necessary confidence in British marks. The President of the Board of Trade and the Minister for Foreign Affairs should be asked to open negotiation on the subject with foreign powers. Another illustration of the want of an internanational Commercial Law was suggested by Mr. Danson, on the part of the Liverpool Chamber of Commerce. Whilst both the United Kingdom and the United States of America have found it necessary and beneficial to limit the liability of shipowners, the legislation of the two countries providing only for their respective subjects, wherever it happens that an American shipowner is brought before the British Courts of Law, or a British shipowner before the American Courts, no limitation of liability would be held to exist, and such shipowner would be held liable for the entire loss caused by the negligence of the master of the ship over whom he could have no control. The question of assimilating the weights, measures, and coins of all countries is also of practical importance, seeing the diversities which exist in the weights and measures of every town and county in the United Kingdom, and the practical inconvenience caused by the trade circulars of the principal shipping ports of Europe being in different denominations, not easily rendered into British measures, weights, and coins. For these and other questions of international Commercial Law, a Conference of Deputies from the principal Chambers of Commerce of Europe, America, India, &c., would be of immense utility; and it could be obtained if her Majesty's Government would co-operate with our Chambers of Commerce.

The working of the Merchant Shipping Act, the Registration of Partners, and the Tribunals of Commerce, are all questions likely to be inquired into next session; and I anticipate that much practical legislation will ensue.

I have the honour to be, dear sir,
Your most obedient servant,
LEONE LEVI.

Home Correspondence.

EXAMINATIONS AND THE YORKSHIRE INSTITUTIONS.

Sir,—Having recently visited the head-quarters of the Yorkshire Union of Institutions, I have examined with much interest their 75 published reports of Institutions associated in that Union; and I think that a page of the *Journal* may be well occupied with a brief summary of what those Institutions say of themselves in reference to the very important subject of the systematic instruction given in their classes.

On a careful examination of the 75 reports, I find that sixteen of them are wholly silent on this subject. Forty-five represent their classes as flourishing—generally, as more flourishing than formerly; and seventeen, which appear to have partially failed in reference to their classes, ascribe their failure to causes, some of which are of an accidental character, and others may be expected to disappear when public opinion on these points is a little more improved.

Thus, Ackworth alleges "some little irregularity in the attendance of the teachers, which was partly caused by the death of a very valuable assistant." Almondbury reports "a decrease in the numbers," but "a more regular attendance, and a better appreciation of the efforts of the teachers." Brighouse says the non-increase of the classes "may be in part owing to the advanced rates of subscription." Churwell suggests religious differences and the over-fatigue of the young work-people. Dewsbury says the non-success "arises more from the want of convenient and comfortable class-rooms than from any other cause." Doncaster hopes to obtain "a building more commodious and otherwise suitable to their requirements for classes." Hartlepool speaks of "commercial depression" and change of site. Wentworth notices the ill-health of a gratuitous regular teacher, but hopes to obtain regular paid teachers in future.

On the other hand, in the reports of the 45 successful Institutions, we find encouraging remarks. Bradford says,—"The third examination by the Society of Arts took place in May last, and in pursuance of a new regulation, its encouraging influences were this year extended to all the principal Institutions in the kingdom. The number of candidates who presented themselves at the preliminary examinations held in this Institute was 22, of whom 18 satisfied the requirements of the Local Board; of the 18, 17 received certificates." Calverly has "a far better attendance in the classes." Halifax (Mechanics' Institution) says, "the classes are in a most efficient condition." "There is a marked improvement in the general behaviour of the youths attending them." Four candidates received certificates from the Society of Arts. Halifax (Working Man's College, Haley-hill) says, "The students in chemistry have kept up the high character they gained in the Society of Arts' Examination, when one of their number carried off the highest certificate but three." "The laboratory has been greatly enlarged." "The list of certificates gained at the Society of Arts' Examination last Whitsuntide (17 in number) shows that real and telling work has been done." West Hartlepool reports, "The number of pupils attending the classes has largely increased." "The Institution, being in connection with the Society of Arts, has adopted their scheme of Examination by a Special Local Committee, which has been honestly carried out, and found to answer well." Three candidates obtained five certificates. Holbeck (Old) says: "The elementary classes are in a most flourishing condition." Holbeck and New Wortley says: "The night classes for junior members have been much more successful during this season than last." Keighley says: "The condition of the classes affords indications of present prosperity and bright and cheering hopes for the future." Kirkby Malzeard, "by means of its evening classes, has done more towards advancing the cause of education than in any previous year." Meltham has classes "very well attended," "owing to having good teachers." Middlesbro' has had its classes "more numerously attended than in previous years," though "the want of good class-rooms has been a great drawback." New buildings are in course of erection. Northowram announces that "the classes still continue the chief feature of the Institution," and that "a local board has been formed in connection with the Society of Arts." Otley has built a new room for its classes. At Settle, "notwithstanding the thin attendance, the committee hope that some are looking forward to the next Examination of the Society of Arts. At Sheffield there have been financial drawbacks, and a change of premises, but 32 candidates were examined, and 26 received certificates from the Society of Arts. Selby thinks that the attendance of young men and boys at its classes deserves a better building. At Undercliff "our classes are in a healthy condition, and there seems to be a general disposition for improvement." At York "the committee regard with peculiar satisfaction the progress made by the pupils in the evening classes." Six students passed the Examination of the Society of Arts.

It should be added that the Young Men's Christian Institute at Leeds, which does not belong to the Yorkshire Union, presented 37 candidates to the Society of Arts, and 29 obtained certificates, and that Selby presented 7, of whom 5 obtained certificates.

From the foregoing review it appears that the Institutions in Yorkshire, connected directly. or indirectly through the Yorkshire Union, with the Society of Arts, are doing an important work under prospects of great encouragement.

The "Local Boards" co-operating with the Society of Arts, at Bradford, Halifax, Hartlepool, Leeds, Northowram, Sheffield, Skipton, Wakefield, Wirksworth, and York, have done good service to the cause of education; and it is to be hoped that next year there may be similar boards, and not worse results, at twice or thrice as many of the towns of Yorkshire.

The arduous work in which our Society is engaged for the benefit of the Institutions, to be thoroughly successful, requires from them the most cordial co-operation in the most generous spirit. It is no mean result that we have already established Local Boards and held Examinations at 54 different places in England, Scotland, Ireland, and Wales. Let us hope, as we have good grounds for expecting, that next year will see not only a great increase in the number of the places where "Local Boards" shall be in operation but an improvement, a more systematic organization, of those that exist. Some of them are already everything that could be desired. All of them are capable of doing their necessary work; and it is desirable that such improvements as may in a few cases be expedient shall be introduced gradually, by the natural growth of the Institution, rather than be prescribed hastily and absolutely by the Society of Arts.

I am, &c.,
HARRY CHESTER.

THE WESTMINSTER BELL.

Sir,—The art of bell founding may be truly called a mystery, for that business has always been confined to a few families, the members of which only communicate the secrets of their profession to those of their descendants who intend to follow the same trade. Having had occasion, however, to employ a family of bell founders for other purposes on my own premises for several years, with leave to cast bells occasionally on their own account, I gradually became acquainted with the whole of their so-called secrets.

The bell founders' scale, or diapason as some call it, is merely a table of weights for every diameter of rim or extreme breath across the mouth, by means of which they are enabled to cast a bell of proper form and sound to any given weight of metal. This table has of course been mostly the result of long practice, but it is no very difficult matter to form such a table by means of accurate geometrical calculations.

The general form of a bell, also the result of long practice, cannot, in all probability, be bettered upon any purely philosophical principles, such as that the cap or head should be exactly one half of the diameter of the sounding bow in order to give a true octave to the fundamental note—a perfect fallacy in practice. There is, besides, every progression in the diameter of the waist, which must therefore give an infinity of discordant notes, so that the only means of producing a fine-toned bell is to give an enormous preponderance of metal to the sounding bow, and to reduce all the rest to that which may be absolutely required for strength alone. It may be observed, however, that every mass of metal hung freely in the air will give, besides the principal note, the chords of three notes properly belonging to the fundamental sound. This fact is illustrated by the familiar expedient of hanging the poker by a tape round the head or in the teeth, and striking it, an experiment which forms the very nucleus of the theory of thorough base.

Bell metal is a mixture of copper and tin, in that proportion which gives the hardest alloy, about 25 per cent. of the tin, an overdose of which produces a softer alloy and very inferior tone. But the metals should be pure, unfortunately not the case with the tin of commerce, even with the duchy seal, always adulterated more or less with lead. This circumstance is a great advantage to the founder, because a small proportion of the baser metals always ensures a good casting, though the result is a brittle crumbling alloy with a bad tone. One of the faults of the first Westminster bell was undoubtedly due to the presence of lead, but a much more serious error was committed when an immense mass of new metallic mixture was used, without first casting the whole into ingots, to be again remelted for the casting of the bell. In the first fusion the baser metals, if present, are much burnt off, and pure copper and tin more fully penetrate each other by repeated meltings. The second Westminster bell had the same faults, though perhaps in a less degree, and for some little time was able to endure the stroke of the hammer.

The application of an elastic cushion to the hammer of the Westminster clock was a fatal mistake in regard to sound, but would have produced the most beneficial result if it had been placed between the catch spring and the arm of the hammer.

In regard to hanging, it has already been observed by others, that the suspension of the bell in the Westminster clock tower, by firmly bolting it to a rigid mass of iron work, was calculated in the highest degree to promote fracture, and destroy its tone, as is well known to musical professors and instrument makers. There is only one mode of hanging a bell so as to produce the loudest and most musical tone with safety from fracture, and that is the old-fashioned way of bolting the crown of dolphins to a block of timber of suitable form and dimensions, itself freely supported upon gudgeons and brasses bearing upon a framework and joists constructed wholly of wood. It is also a matter of importance that the clapper be not shackled to the ring or staple in the crown, but suspended to it by means of a strong loop or round robbin of doubled hide; and further, all those contrivances intended to turn the bell round so as to present continually a new surface to the blow of the hammer, greatly diminish the volume of sound and are ruinous to the tone.

The ultimate distance at which the sound of a bell may be heard depends upon many circumstances, but principally on the mode of ringing and the formation of the bell chamber. The best position of the bell, if intended to be rung out, is in one of the windows, when at every return oscillation it will present its mouth to the country, and accurately represent the bell mouth of a trumpet. I will venture to assert that our bells, as usually fixed in our English church steeples, are not heard to one-quarter the distance they would if properly hung and rung out.

When too large to be rung out, they should be suspended exactly in the centre of the bell chamber, without incumbrance of any kind, or blinds, or weather boarding in the apertures, and the level of the brim should be at about one-third of the height of the windows. In ringing large bells by the clapper, a very good imitation of ringing out may be obtained by means of two heavy beam treadles, sufficient to balance the weight of the clapper when near the brim or sounding bow. The connection with the clapper may be formed by a double rope passing over two large pulleys running freely on their bearings, or by a pair of bell-cranks. By treading on each lever alternately the bell is made to sound as if rung out with the greatest ease.

The splendid bell of St. Peter's, at Rome, is rung in this manner. It is over seventeen thousand pounds weight, or eight tons, but the fine bell of Santa Maria del Fiore, at Florence, is rung out, though little inferior in weight.

A proposition has lately been made to preserve the present cracked bell for use by drilling and sawing. This expedient is of ancient date, and has never succeeded with large bells, only producing a horrid scream, very different of course from the original note. But I very much doubt the practicability of the experiment if the metal be of the proper temper, and free from the presence of zinc or lead, when it is so hard as absolutely to resist the best Sheffield file.

The foregoing observations do not apply to small bells, which must be thin at the edge in order to sound well, as they assimilate in some degree to the nature of the Chinese gong, an extraordinary production, for it is evidently made by the hammer, yet so hard as to be pounded to powder like glass. The gong is undoubtedly made and finished in pure malleable copper with the hammer, and afterwards hardened by some unknown process of cementation with pure tin. The price in China of a first-rate gong is only about five pounds.

I am, &c., HENRY W. REVELEY.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Royal Inst., 2. General Monthly Meeting.
Brit. Architects, 8. Mr. Tite, M.P., "On the Present Condition and Future Prospects of Architecture."
TUES. .. ...Syro-Egyptian, 7½. Dr. Heinrich Jolowicz, "On Manetho's History."
Civil Engineers, 8. Mr. Jabez James, "On the Process of Raising the Bells, in the Clock Tower, at the New Palace, Westminster."
Medical and Chirurg, 8½.

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, October 28th*, 1859.]

Dated 29th August, 1859.

1968. R. Besley, Faun-street, Aldersgate-street, London—Imp. in machinery for printing and for numbering and perforating documents. (A com.)

Dated 13th September, 1859.

2084. W. B. Adams, 1, Adam-street, Adelphi—Imp. in the permanent way of railways.

Dated 21st September, 1859.

2146. G. K. Geyelin, 462, Oxford-street—Imp. in machinery for making solid, hollow, and perforated bricks, also tiles, drain and socket pipes.
2150. G. D. Robinson, 15, Church-street, Islington—Imp. in apparatus for regulating the pressure of gas and other fluids.

Dated 26th September, 1859.

2176. R. Kay, Busby, Renfrew, N.B.—Imp. in preparing and bleaching textile fabrics and materials, and in the machinery or apparatus employed therein.

Dated 28th September, 1859.

2196. J. F. Stanford, 7, Denbigh-place, Pimlico—An improved apparatus for giving warmth to the lower extremities and members of invalids and others when travelling, or in churches, chapels, theatres, rooms, carriages, and other similar places, and on ship-board, and also for airing carriages.

Dated 29th September, 1859.

2204. T. Allan, Adelphi-terrace, Westminster—Imp. in applying electricity for telegraphic purposes, and in apparatus employed therein.

Dated 30th September, 1859.

2214. E. Sonneborn, 39, Finsbury-square, London—An imp. in the manufacture of cement.

Dated 1st October, 1859.

2230. J. Baughan, Pimlico—Imp. in the manufacture of soap.

Dated 3rd October, 1859.

2236. R. A. Brooman, 166, Fleet-street—Imp. in treating clay, and in the manufacture of bricks, tiles, and other like articles, and in machinery employed therein. (A com.)

Dated 5th October, 1859.

2252. F. J. Dove, Studd-street, Islington—Iron clasped bonding plates for joists and other building purposes.
2256. W. G. S. Mockford, 67, Upper Thames-street, London—Imp. in the manufacture of starch.
2260. T. H. Dodd, Bessborough-place, Pimlico—Imp. in portable apparatuses for the use of smiths, carpenters, and other workmen.
2262. W. E. Newton, 66, Chancery-lane—Imp. in blankets used for printing calicoes and other fabrics, and in the mode of washing or cleaning the same. (A com.)
2264. J. Prichard, 6, Whitehall, Middlesex—Imp. in spurs.
2266. J. Webster, Birmingham—An improved construction of spring for carriages and other purposes.
2268. J. Turpie, North Shields—Imp. in the fore and aft gaff and boom sails of ships.
2270. G. Long and J. Archer, Landport, Hants—Imp. in the manufacture of manure.

Dated 6th October, 1859.

2272. J. P. Scott and E. Scott, Manchester—An improved instrument for boring and drilling. (A com.)
2276. E. O. Tindall, Scarborough—Imp. in machinery or apparatus for crushing or reducing grain, seeds, and other substances.
2278. A. M. Ferry, Edinburgh—Imp. in the manufacture or production of oil, and in lamps for burning the same.
2280. A. Hind, 60, High-street, Poplar, and J. Lowenthal, 16, Little Tower-street—Imp. in the manufacture of pottery and china wares. (A com.)
2282. R. Warry, Brompton Barracks, Kent—Imp. in breech-loading ordnance, and in projectiles for the same.
2284. G. Gibson and J. Gibson, Southall, Middlesex—Improved machinery for raising and removing soil or earth from sewer and other excavations.

Dated 7th October, 1859.

2286. W. Brookes, 73, Chancery-lane—Imp. in securing the tyres of railway carriage and engine wheels. (A com.)

Dated 8th October, 1859.

2290. W. Dawson, Blackburn, and T. Singleton, Over Darwen, Lancashire—Imp. in apparatus applicable to looms for weaving.
2292. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in the treatment of fatty matter. (A com.)
2294. P. Robertson, Sun-court, Cornhill—Imp. in preparing, boiling, and fermenting worts, and in maturing beer, spirits, and cyder.
2296. H. Monument, Myrtle-street, Dalston, and G. Berry, Butteslan-street, Shoreditch—Imp. in apparatus for raising and moving earth, and other matters and bodies.

Dated 10th October, 1859.

2297. J. S. Parfitt, 60, Boulevart de Strasbourg, Paris—A registering nautical velocimeter, for measuring the speed of ships, and also of currents of water.
2299. C. A. Shaw, Biddeford, U.S.—Imp. in machinery for shaping or bending tinned sheet iron, and other sheet metal. (A com.)
2300. T. Knowles and J. Knowles, Manchester, and A. Rigg, Chester—Imp. in machinery or apparatus for shaping, cutting, punching, and drilling metals, which improvements are also applicable to presses.
2301. G. White, 34, Dowgate-hill, Cannon-street—Imp. in frames for spinning and twisting yarn of any description of textile materials. (A com.)
2303. S. B. Parker, Deptford, Kent—A method of, and apparatus for, revivifying oxide of iron, and other agents, for purifying gas containing metallic particles.
2304. W. Martin, jun., Dundee—An improved method of damping linen and other textile fabrics.

Dated 11th October, 1859.

2305. L. J. Jeannin, Pontarlier, France—A new system of pumps.
2306. C. F. Beyer, Gorton Foundry, near Manchester—Imp. in machinery for boring and drilling.
2307. J. L. Tenting, senr., Paris—Imp. in the construction of buffers for railway and other carriages, also applicable to other purposes where springs are employed.
2308. J. L. Tenting, senr., Paris—Imp. in the construction of the axles of railway and other carriages.
2309. J. Earl, Melbourne, Derbyshire—Imp. in arranging and applying harness to the draft of carriages.
2310. W. D. Hart, Edinburgh—Imp. in pressure regulating apparatus for gas burners.
2311. J. Smith, Oldham—Imp. in breech-loading fire-arms and ordnance.
2312. P. G. Cunningham, Salisbury, Wiltshire—Imp. in the construction of artificial teeth and gums.
2313. A. Whytock, 12, Little Saint Andrew-street, Upper Saint Martin's-lane—Imp. in coating sheets of metal with other metals and other substances.
2314. A. V. Newton, 66, Chancery-lane—An improved mode of clarifying and defecating saccharine solutions and juices. (A com.)
2315. F. A. Lohage, Unna, Westphalia, Prussia—An improved construction of water wheel. (A com.)

Dated 12th October, 1859.

2316. J. Skertchly, Ashby-de-la-Zouch, Leicestershire—Imp. in the manufacture of mosaic and other ornamental tiles and slabs, and in apparatus connected therewith.

2317. G. Scott, 3, Priory cottages, Peckham, Surrey—Imp. in generating elastic fluids and in the apparatus for that purpose.

2318. W. Day, Burton Latimer, near Wellingborough, Northamptonshire—A direct-action rotary steam engine.

2319. A. A. De Reginald Hely, 2, Park-village West, Regent's park—Certain imp. in the manufacture of tobacco for smoking purposes.

2320. J. Carrick, Glasgow—Imp. in commodes, water closets, and other sanitary appliances.

2321. Z. Nuttall, Stockport—Imp. in looms for weaving.

2322. J. Thomson, Notting-hill, Middlesex—An improved form of hydraulic valve and apparatus to be used in the manufacture of gas.

2323. T. Rothwell, Manchester—Imp. applicable to warehouses and other buildings in which "well-holes" are constructed for the purposes of light and ventilation.

2324. E. H. Baron and J. Wheater, Lee Mill, near Bacup, and L. Tatley, Crawshaw Booth, Lancashire—Certain imp. in carding engines for carding cotton, wool, or other fibrous materials.

2325. J. Tangye, Birmingham—A new or improved method of actuating certain kinds of motive-power engines, and in the distribution of motive-power.

2326. E. H. Taylor, Rubicon Works, Saltney, Chester—Imp. in apparatus applicable to the permanent way of railways.

2327. C. H. Southall, Blackburn—An improved apparatus for making and finishing boots and shoes.

2328. C. P. Moody, Corton Denham, Somersetshire—A method of, and apparatus for, raising grass and other crops on to stacks, which apparatus is also applicable to raising and transferring weights.

2329. T. B. Daft, Tottenham, Middlesex—Imp. in flexible valves.

2330. H. Bright, Sandwich-street, Burton-crescent, Middlesex—Imp. in machinery or apparatus for navigating the air.

2331. T. Twells, Nottingham—Imp. in machinery and apparatus connected therewith for embroidering or ornamenting woven, looped, or lace fabrics.

Dated 13th October, 1859.

2333. J. Rhone, Leman-street, Whitechapel—An indicating meter tap.

2335. J. Hunter, Kilmahumaig, N.B.—Imp. in machinery or apparatus for ploughing or cultivating land.

2337. L. H. Rousseau, 29, Boulevart St. Martin, Paris—Imp. in steam engines.

Dated 14th October, 1859.

2341. F. Levick, Monmouth—An imp. or imps. in the manufacture of iron.

2345. J. Jack, Liverpool—Certain imp. in steam engines and boilers for marine and land purposes.

2347. T. Robinson, St. Helen's, Lancashire—Imp. in annealing or softening wire.

Dated 15th October, 1859.

2349. W. E. Newton, 66, Chancery-lane—An imp. in the mode of applying india-rubber, gutta-percha, or other elastic substances to give elasticity between the tires or outer rims, and the hubs or naves of railway or other wheels, and between other metallic bodies. (A com.)

2351. F. A. Leigh, Manchester—Imp. in machinery or apparatus for the manufacture of screws, bolts, and nuts. (A com.)

2353. R. Bate, Castle Mills, Stalybridge, Lancashire—Imp. in engines for carding cotton and other fibrous substances. (A com.)

2355. J. Echard, Paris—Imp. in machines and apparatus for ploughing and sowing. (A com.)

2357. J. H. Brown, Abbey Mill House, Romsey, Hants—Imp. in the preparation of gunpowder for loading ordnance and fire-arms.

Dated 17th October, 1859.

2361. G. Berry, 19, Buttesland-street, Middlesex—Imp. in the construction of glass and earthenware vessels for containing fluids, particularly such vessels as are intended to contain fluids which may exert dynamic force on the stoppers of such vessels.

2363. L. Vidie, Paris—Imp. in transmitting the motion of steam engines.

2365. G. W. Reynolds and E. Dance, Birmingham—A new or improved manufacture of baskets and other articles usually made of wicker work, and new or improved machinery to be employed in the said manufacture.

2367. W. E. Newton, 66, Chancery-lane—Imp. in preserving and disinfecting organic substances. (A com.)

2369. J. Bernard, Albany, Piccadilly—Imp. in the manufacturo or production of boots and shoes, and other coverings for the feet, and in the machinery, apparatus, and means connected with such manufacture.

2371. D. Jones, Bassaleg, Monmouthshire—Imp. in self-acting breaks to be used on railways.

2373. W. Hall and A. Wells, Erith, Kent—Imp. in the manufacture of ropes and cords.

Dated 18th October, 1859.

2375. G. Canouil, 93, Curtain-road, Shoreditch—Cartridge's paper, chemically prepared for percussion fire-arm.

2377. J. Reynolds, 21, Bull and Mouth-street, London—Imp. in the manufacture of wrought nails. (A com.)

2379. G. T. Bousfield, Loughborough-park, Brixton—Imp. in machinery for steering vessels. (A com.)

2381. C. Hill, Cheddar, Somersetshire—An improved fastening for stays and other purposes.

2383. W. E. Newton, 66, Chancery-lane—An improved method of making combs or gills employed in the preparation of fibrous substances. (A com.)

2385. A. S. Rott, Thann, France—The preparation of certain substances for fixing colours in dyeing and printing, and for other purposes.

Dated 19th October, 1859.

2387. G. Worssam, 3, Oakeley-crescent, City-road—An imp. in non-condensing steam engines.

2389. J. Gordon, 3, Railway-place, Fenchurch-street, London—Imp. in machinery or apparatus for pulping coffee.

2391. T. Spencer, 192, Euston-road, Euston square, Middlesex—Imp. in the manufacture of carbonate of soda.

2398. C. Cowper, 20, Southampton-buildings, Chancery-lane—Imp. in photographing on uneven surfaces, and in apparatus for that purpose. (A com.)

2395. J. J. Bowen, 136, Great Dover-street, Southwark—Imp. in manufacturing the pots for containing liquids used by publicans and others.

2397. W. Warne, J. A. Jaques, and J. A. Fanshawe, Tottenham, Middlesex—Imp. in the manufacture of elastic hoops or bands and other analogous elastic articles, applicable to various parts of ladies' and gentlemen's wearing apparel, and in the machinery employed in such manufacture.

2399. J. R. Palmer, Newport-cottage, Old Ford, Bow—Imp. in the manufacture of printing-ink and paints and varnishes, and also in the manufacture of lacquers, japans, and blacking.

Invention with Complete Specification Filed.

2413. J. Avery, Essex-street, Middlesex—Imp. in rail-road weighlocks and other platform scales. (A com.)—22nd October, 1859.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, October 28th*, 1859.]

October 27th.

1053. G. Pearson.
1058. R. J. Laing.
1061. T. Lacey.
1068. N. Libotte.
1069. N. J. Holmes.
1070. E. Lardenois.
1071. T. Clarke.
1072. J. Wheat.
1076. W. Corbett & W. Carmont.
1077. J. W. Welch.
1081. T. Smith.
1082. W. Winstanley & J. Kelly.
10·4. J. Darlington.
1085. E. Francis.
1087. W. Clark.
1091. J. Souquiere (called Emile)
1092. T. H. Arrowsmith.
1095. W. Bayliss.
1096. R. A. Brooman.
1097. J. Basford.
1101. W. Gossage.
1103. F. W. Emerson.
1106. T. W. Miller.
1107. W. Clark.
1114. E. W. Scale.
1115. R. Mushet.
1116. W. H. Kingston.
1123. J. F. Allender and D. Rowley.
1140. S. Wright.
1145. G. T. Bousfield.
1148. A. C. Bamlett.
1149. M. Henry.
1150. R. Mushet.
1151. R. Mushet.
1157. J. Ramsbottom.
1174. M. Henry.
1176. W. O. Bourne.
1185. W. Spence.
1188. J. B. Lyall and F. W. Campin.
1193. T. R. Oswald.
1223. J. Brown, jun.
1237. J. H. Johnson.
1239. J. Childs.
1242. R. Wilson.
1257. W. H. Perkin & M. Gray.
1305. W. H. Nevill.
1308. J. C. Bent.
1320. W. H. Graveley.
1327. E. Breffit.
1419. A. V. Newton.
1440. S. Levy.
1540. A. V. Newton.
1560. J. Lawson and S. Cotton.
1628. J. H. Johnson.
1661. J. Coombe.
1731. W. E. Newton.
1742. J. Davies.
1812. W. R. Drake.
1836. J. Cannon.
1840. G. T. Bousfield.
1860. W. De la Rue and Dr. H. Muller.
1919. Hon. W. Talbot.
1930. T. Richardson.
1965. D. Todd.
2001. W. Brown and S. Bathgate.
2032. J. J. Sieber.

Patents on which the Stamp Duty of £50 has been Paid.

[*From Gazette, October 28th*, 1859.]

October 25th.

2557. J. Lawson.

October 26th.

2650. W. Clark.

[*From Gazette, November 1st*, 1859.]

October 27th.

2527. W. S. Losh.
2539. T. C. Salt.
2578. S. Middleton.

October 28th.

2530. J. Armstrong.
2541. T. S. Henzell.
2547. J. T. Way.
2569. J. C. Sinclair.

Patents on which the Stamp Duty of £100 has been Paid.

[*From Gazette, October 28th*, 1859.]

October 25th.

519. M. Fitzpatrick.
525. M. Myers, M. Myers, and W. Hill.
543. J. Norton.
572. H. Brinsmead.

October 26th.

552. G. Hattersley.
756. F. M. Jennings.

[*From Gazette, November 1st*, 1859.]

October 28th.

579. A. V. Newton.
710. J. Noble.

Journal of the Society of Arts.

FRIDAY, NOVEMBER 11, 1859.

NOTICE TO MEMBERS.

The One Hundred and Sixth Session of the Society will commence on Wednesday next, the 16th inst., when the First Ordinary Meeting will take place. Sir Thomas Phillips, Chairman of the Council, will deliver the opening Address. The Chair will be taken at Eight o'clock on the following Wednesday evenings :—

1859.	November	—	—	16	23	30
,,	December	7	14	21	—	—
1860.	January	—	—	18	25	—
,,	February............	1	8	15	22	29
,,	March	7	14	21	28	—
,,	April	—	11	18	25	—
,,	May	2	9	16	23	30
,,	June	—	—	—	—	27*

The following are the arrangements for the Meetings previous to Christmas :—

November 16.—Opening Address by Sir Thomas Phillips, F.G.S., Chairman of the Council.

⁂ On this evening the Medals which were awarded by the Council for Papers read at the Weekly Evening Meetings during the last Session, and for articles submitted to the Society's Committees, will be distributed.

November 23.—" On China, and its Relations to British Commerce." By Sir John Bowring, F.R.S.

November 30.—" On the Prevention of Accidents in Coal-Mines." By Mr. P. H. Holland.

December 7.—" On the Forces used in Agriculture." By Mr. J. C. Morton.

December 14.—" On the Great Eastern." By Mr. William Hawes.

December 21.—" On Starches ; the purposes for which they are employed, and the improvements in their manufacture." By Mr. F. Crace Calvert, F.R.S.

THE LATE ROBERT STEPHENSON.

The following notice has been contributed by a Member of the Society :—

He was born on the 16th of November, 1803, and died, full of labours, on the 12th of October, 1859.

Why has his death more stirred the public mind than that of any man of modern times—not of the military or governing classes ? Surely a life of incessant industry in works of utility, united to an instinctive geniality of nature, has brought forth this universal wail for his loss.

What is engineering ? What but a wide knowledge of the materials of nature, and a faculty, as universal, of converting them to artifical uses, having reference to the progress of man physically, and, consequently, mentally also.

Utility, then, is the basis of engineering, and nothing that pertains to utility is unworthy the notice of the engineer, whether making shoes or building bridges. All are means of transit.

The term engineer possibly has some reference to the Latin *ingens*, great, distinguishing the larger operators from the smaller, as the maker of a steam-engine from the maker of a watch, though the same faculties frequently comprehend both, as in the case of Watt. There is one great distinction in the works of the engineer, those which are motionless or stationary, and those intended for movement; and there can be no doubt that he who comprehends the latter will be better fitted for the operations of the former. Other things being equal, the mechanical engineer will find it an easier thing to become a civil engineer than the civil engineer will find it to become a mechanical engineer. The civil engineer is not of necessity obliged to calculate his materials to a nicety, because stationary structures have only to rest. The mechanical engineer must nicely balance and proportion every part of his machines.

Neither the one nor the other are artists, *i.e.*, they do not construct objects for the mere pleasure of looking at them. Their first consideration is utility, and all that is ornamental must grow out of, and be based on the utility.

But there is more than mere utility. The world is full of useful things. Beyond this, there is the originality to foresee human wants, and to create new useful things. This is a very different thing from the morbid imagination which seeks merely to make new things, or to vary the forms of old things without regard to utility. In engineering, the *cui bono?* must be rigidly demanded. A philosophical toy is not the object sought for by a commercial people. The value of the aqueduct of Alcantara is not in the height of the tall piers which please the eye, but in the stream of water that runs above them, supported by them. If a cheaper pipe below ground will convey the water at less cost, he is the best engineer who takes to the pipe in preference.

But the engineer must be born to deal with more than mere matter. Huge displacements and alterations of material must be executed by human hands, and human hands are but a prolongation of human hearts governed by human emotions. The same high qualities that govern an army of soldiers—not savages—are also needed to govern an army of navvies and the officers who marshal them. The general who would be successful must acquire the love and devotion of his people, or his plans may fail in execution. Nor will it do to *pretend* to regard the welfare of his people. His regard must be in him an instinct of humanity, the out-growth of a large nature.

Let us examine Robert Stephenson by the light of these tests.

He was almost born in the coal pit, but became a proficient at school in mathematics and chemistry, took suit and service under Nicholas Wood, as a coal miner, and then went to North America as a mining engineer. Returning thence by way of the United States, he became a builder of locomotives at Newcastle, and coupling all this with several records of his name in the patent list, there can be little doubt that he was a competent, practical mechanic, master of those arts that are at the base of all civil engineering.

The London and Birmingham proper bears testimony to his capacity as a civil engineer, embracing many kinds of railway work, the first of a series of lines leading from London to Berwick. The world is now so familiar with railways, that what the originators had to go through, mentally and physically, in what were then new features—new when compared with the weights to be borne along the line—is almost forgotten. Kilsby tunnels could now be made more easily and cheaply than that which set the type ; and so also the iron roof at Euston, the original, we believe, of all, was then regarded as a marvel. Had Robert Stephenson now to make the London and Birmingham, with all the aggregated knowledge gained in the making of it, there is, possibly, no part of it that he would not alter in concurrence with progress. His father made the gauge, and quite in accordance with utility as then understood, in proportion to population and traffic, amidst all the thwartings of the great impediment makers in high and low places, and that gauge once set up it was impossible to alter it by anything short of commercial convulsion. The gauge of India is a proof of what Robert Stephenson would have made the English gauge if he had but to begin anew. But the Liverpool and Manchester had stamped the gauge for all its connections before he came upon the field. To go through the history of what he did as a maker of railways is simply to recapitulate what all the world knows. Some two thousand miles of line, representing millions of capital, testify to the faith that capitalists and inventors had in him, in England, Belgium, Italy, Switzerland, Canada, Norway, and Egypt.

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* The Annual General Meeting: the Chair will be taken at 4 o'clock. No Visitors are admitted to this Meeting.

In making railways, at the outset the desire was to obtain as nearly as possible a dead level, and in the then existing state of knowledge it was right. The powers of the locomotive were in embryo, and there were no means of knowing how far it was desirable to consume daily coal in preference to daily interest on capital. It is quite certain that, as capital becomes abundant and population thickens, many of the bad gradients on our present lines will be improved, because risk to life from inclines will not be tolerated, a risk which is always great when inclines are passed over by frequent trains.

That Robert Stephenson was an efficient engineer there can be no doubt, so far as the construction of works went, and, upon the whole, his works were cheaply executed, considering the increase of value given to all materials by the great demand consequent on the nine and ten per cent. revenues of the Liverpool and Manchester, the Grand Junction, and the London and Birmingham.

In the construction of bridges, it does not appear that he sought after any object but utility. In one sense, the Britannia-bridge over the Menai Straits was not his work. It was forced on him by the Admiralty. A clear height of one hundred feet above high water was demanded, and no pier permitted save on the natural rock in mid stream, leaving spans of upwards of 400 feet. This was the problem set him to solve by the Admiralty out of his own brains in the best manner he could.

An arch was out of the question; the level below and the level above forbade it. The Menai-bridge of Telford gave no hope for a locomotive, and so Robert Stephenson bethought him of the strength of an iron ship he once saw bestriding the crest of a wave off Newcastle, without breaking her back, and then his imagination took the form of a hollow tube, with a train rolling through it. Mr. Hodgkinson and Mr. Fairbairn were then set to work to experiment on this idea. A round tube was made, and crushed, and then, without further trial, a square tube was resorted to. That also was crushed, but means were resorted to of strengthening it with cells at the top and bottom, till the requisite resistance was attained. Had the round tube been strengthened in a similar mode, a similar result would have been obtained, as Mr. Fairbairn professes to have lately discovered in the application of flanges externally to circular boilers. Thus, with no previous knowledge of any such structure of bridges, but only by process of observation and analogy, Robert Stephenson solved for the Admiralty their problem, at an enforced cost to the shareholders, but not of his seeking.

Here was a work, novel in construction and of then monster proportions, successfully planned and successfully executed. After this it was comparatively easy to make similar bridges. How it was executed is well told in a pictorial tale, largely published as an engraving, where the chief is surrounded by his people all working in harmony, and there is a gracious smile of approval on his face while examining the plans for the proposed lifting of the tube, with explanation ofdetails by the resident engineer; and grouped around are various members of his profession, watching all the details that were to confer a new knowledge on the world in the process of lifting weights, that cast into the shade all that had ever been done before in the ancient or modern world, whether in pyramid or pillared temple. No sign of mutiny or of dissatisfaction was there seen; all worked with a will and energy that only affection could have called into action.

As regards the engineering judgment of Robert Stephenson, there were three important questions on which he gave decided opinions. One was the question of the gauge—the broad or the narrow. He adhered to the latter in various reasons set forth in the blue books, containing minutes of evidence before the legislature. We may fairly take the utilitarian test of dividends as the verdict of the public on this point.

Another question was the proposed substitution of the traction by the atmospheric tube as an improvement on the locomotive engine. Robert Stephenson battled for the locomotive—his father's heir-loom—with all his might and main. He failed to convince men's minds at the time, so plausible was the atmospheric system; but the soundness of his judgment was proven by the utter failure of the scheme in more places than one under different engineers. The only fragment left of the system is the mile-and-a-quarter on the Dalkey incline of the Dublin and Kingston, where it first originated—a mechanical toy, of no value in itself, but merely an attraction to bring travellers on to the other portions of the line—a scheme about on a par with the Montagnes Russes, which excited the wonder of all Paris in the year 1818.

The question of the cutting a canal through the Isthmus of Suez, set on foot by M. Lesseps, was formally negatived by Robert Stephenson. He had once entertained the idea himself, founding his calculations upon a survey made by the elder Napoleon, but so soon as the survey was verified, it was found, like many other public documents of the period, to be based upon an untruth. The Red Sea had not, as then proved, a higher level than the Mediterranean, and Robert Stephenson, after expending his own money, was especially careful not to encourage any delusion tending to waste the money of public companies. Had the Red Sea really been of the higher level reported by the French savant, it is tolerably clear that it would long since have opened a passage for itself through the sandy border, and made its own canal through the low level intervening between it and the Mediterranean.

We have lost a great man ere he had attained the specified span of life. We have many men whose individual knowledge of details in the various arts he practised as combining to form the great engineer, may be greater than his was; but we have no greatly *prominent* man, who, at this time, adds to a wide knowledge of physics in the practical arts, the geniality of nature and sound judgment that link men together for works of high emprise, together with the moral worth that ever obtained implicit confidence from the shareholders whose capital was placed at his disposal. Large were his dealings with men, many were those who worked for him; but there are none whose tongues speak of him save with respect and affection. His name will ever remain amongst us as one of those who have raised England to her condition of eminence, and whose memory we may recollect with pride. The skill and enterprise of the old Norsemen in the daring deeds of war have taken the shape of deeds as daring in the work of civilisation, in which phase Robert Stephenson ranks as a hero, lofty as any of the elder Vikings in their vocation—immeasurably higher in that progress which is ever winning the world from the wilderness.

MEETINGS FOR THE ENSUING WEEK.

MON. ......Royal Geographical (Burlington House), 8½. 1. Captain McClintock, R.N., "Discoveries by the late Expedition in search of Sir John Franklin and Party, &c.," 2. Mr. Francis Galton, "Sun-Signals for the use of Travellers (Hand-Heliostat)."

Medical, 8½. Dr. Habershon, "On Pain as a Symptom of Disease of the Stomach."

TUES. .. ...Civil Engineers, 8. Mr. C. E. Amos, "Description of the Government Water-works, Trafalgar-square."

Statistical, 8. 1. Sir F. H. Goldsmid, Bart., "On the Recent Statistics of Prussia." 2. M. Wilhelm Lazarus, "On German Railways."

WED. ......Society of Arts, 8. Sir Thomas Phillips, Chairman of Council, "Address on the Opening of the 106th Session."

Geological, 8. 1. Sir R. I. Murchison, "Supplemental Remarks on the Geology of the North-West Highlands." 2. Mr. T. W. Atkinson, "On some Fragments of Copper Ornaments found in Auriferous Sand in Eastern Siberia." 3. Rev. J. E. Woods, "On the Geology of a part of South Australia."

THURS......Linnæan, 8. 1. M. Carnel, "On a New Kind of Butter-Tree from W. Africa." 2. Mr. Oliver, "On New S. American *Utriculariæ*, from Prof. Jameson and Mr. Spruce." 3. Dr. Seemann, "Memoir on the Family of *Crescentiaceæ*."

PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[*From Gazette, November 4th*, 1859.]

Dated 31*st August*, 1859.

1982. G. S. Fleming, 498, New Oxford-street—Imp. in candles for the purpose of indicating time, and the facility of lighting the same.

Dated 26th September, 1859.

2178. G. Addenbrooke, Greenhill Wimbourn, Wolverhampton—Imp. in raising and lowering boats and other vessels from one water level to another, applicable in inland navigation.

Dated 28th September, 1859.

2198. E. T. Simpson, Walton, near Wakefield, Yorkshire—Imp. in apparatus for condensing distilled fatty matters.

Dated 6th October, 1859.

2274. E. O'Connell, Bury, Lancashire—Imp. in apparatus for supplying liquid nourishment to infants, invalids, and others, and for warming or heating the same.

Dated 7th October, 1859.

2288. J. Dixon, Newcastle-upon-Tyne—Imp. in apparatus for supplying water to water-closets.

Dated 10th October, 1859.

2302. G. Davies, 1, Serle-street, Lincoln's-inn—Imp. in the manufacture of paper pasteboard and cardboard. (A com.)

Dated 13th October, 1859.

2332. A. Holden, North-end, near Stalybridge, and J. Holden Micklehurst, Chester—Imp in machinery used in washing, dyeing, sizing, and drying yarn and thread.
2334. W. Prosser, 24, Dorset-place, Dorset-square, Middlesex—Imp. in apparatus employed in the production of light.
2336. W. Burgess, Newgate-street—Imp. in reaping and mowing machines.

Dated 14th October, 1859.

2339. C. Collins, Lower-road, Islington—Imp. in the manufacture of grease for lubricating the axles of railway and other carriages, the journals of machinery, and for other like purposes. (A com.)
2342. J. P. Henderson, Summerford-house, Stirling, N.B.—Imp. in stopcocks or valves.
2343. G. Price, Wolverhampton, Staffordshire—Imp. in locks.
2344. J. Varley, Radcliffe, Lancashire, and J. Crowther, Bradford, Yorkshire—Imp. in steam engines and boilers.
2346. G. Goldsmith, Leicester—Imp. in gas meters.
2348. H. W. C. Wise, Titchfield, Hampshire—An improved domestic apparatus for making tea, coffee, and other such like beverages.

Dated 15th October, 1859.

2350. H. Chapman, Battlebarrow, Appleby, Westmoreland—An improved self-acting safety railway break.
2352. J. Fernihough, Dukinfield, Chester—Imp. in the construction of steam boilers and apparatus connected therewith.
2354. J. H. Johnson, 47, Lincoln's-inn-fields—Imp. in machinery or apparatus for breaking stones. (A com.)
2358. N. Montanari, Charles-street, Soho-square, Middlesex—An improved apparatus for aiding children in learning to walk.
2360. J. Elder, Glasgow—Imp. in steam and other engines.

Dated 17th October, 1859.

2362. W. K. Hall, 36, Cannon-street, London—Imp. in apparatus for manufacturing cotton wadding. (A com.)
2364. S. Newberry and H. Moore, Burnley, Lancashire—Certain imp. in looms for weaving.
2366. W. E. Newton, 66, Chancery-lane—Imp. in rotary steam-engines. (A com.)
2368. W. Norton, Hollybank, Cavan—Imp. in kilns for drying grain.
2370. J. Thom and A. Kennedy, Glasgow—Imp. in looms for weaving.
2372. R. A. Brooman, 166, Fleet-street—Imp. in electro-magnetic engines, and in apparatus connected therewith. (A com.)
2374. W. Tillie, Londonderry—Imp. in sewing machines.

Dated 18th October, 1859.

2378. A. W. Williamson, University College—Imp. in obtaining extracts from poppies.
2380. J. Higgins and T. S. Whitworth, Salford—Imp. in machinery or apparatus for preparing and spinning cotton and other fibrous materials.
2382. W. E. Newton, 66, Chancery-lane—Imp. in machinery used for preparing for spinning silk, wool, or other fibrous substances. (A com.)
2384. H. Hirsch, Berlin, Prussia—A new propeller for ships.

Dated 19th October, 1859.

2386. J. H. Banks, Radnor-street, Manchester—Imp. in machinery for boring, cutting, moulding, and carving wood, stone, and other materials.
2392. C. Seton, Edinburgh—Imp. applicable to the wheels of carriages generally for the purpose of reducing the draught thereof.
2394. G. Hart, 6, Chapel-street West, Mayfair, Middlesex—Imp. in the manufacture of hats.
2396. J. Bruckshaw, Longslow, H. Bruckshaw, Hinstock, and W. S. Underhill, Newport, Salop—Imp. in machinery for elevating grain or other similar substances.

Dated 20th October, 1859.

2400. E. T. Hughes, 123, Chancery lane—Imp. in machinery or apparatus for compressing and making caps for cartridges. (A com.)
2401. R. A. Brooman, 166, Fleet street—A cryptographic machine or apparatus for carrying on secret correspondence. (A com.)
2402. P. A. Godefroy, King's Mead-cottages, New North-road, Islington—Imp. in the construction of submarine cables.
2403. F. Nivelle, Paris—Imp. in sewing machines.
2404. J. Hodgson, Liverpool—Imp. in building ships and vessels.
2405. C. Hanson, Tottenham Court-road, Middlesex—Imp. in fire-arms and ordnance.

Dated 21st October, 1859.

2406. J. Musgrave, Globe Iron Works, Bolton-le-Moors, Lancashire—Certain imp. in steam boilers.
2407. J. H. Green, Christiansberg, U.S.—A composition for coating metals and other substances for various purposes.
2408. J. T. Pitman, 67, Gracechurch street—An improved mode of converting cast iron into soft malleable iron without change of form. (A com.)
2410. G. T. Bousfield, Loughborough-park, Brixton, Surrey—Imp. in apparatus for steering vessels. (A com.)
2411. T. S. Prideaux, Willow-house, Hampstead—Imp. in the construction of ships and rafts.
2412. W. Maltby, De Crespigny-park, Camberwell, Surrey—Imp. in refining oil.

Dated 22nd October, 1859.

2414. P. Jones, Manchester—Imp. in machinery or apparatus for suspending, carrying, and laying down paper, woven fabrics, paper-hangings, and all kinds of flexible materials during and after the process of drying, and also for giving a continuous positive motion to the suspending rods or spindles.
2415. G. B. Mill, Toronto, Canada West—Imp. in pressure regulating apparatus for gas burners.
2416. W. Fox, Amiens, France, and J. Willis, Little Britain, London—Imp. in the manufacture of umbrellas and parasols, part of which improvements is applicable to other purposes.
2417. R. A. Brooman, 166, Fleet-street—A method of preparing inoxidizable oils and fats to be employed as lubricating substances. (A com.)
2418. W. Brookes, 73, Chancery-lane—Imp. in machinery or apparatus for preparing wool and other fibrous materials. (A com.)
2419. S. Beardmore, 27, Albion-street, Hyde-park—Imp. in electric telegraphs.
2420. W. Thorold, Norwich—Imp. in apparatus applied to locomotive engines for condensing steam.
2421. J. Dahlke, Providence-row, Finsbury—Imp. in the preparation of charcoal, and its application to the purification of water and the preservation of organic matters, and in apparatus connected therewith.
2422. F. Wrightson, Birmingham—Imp. in purifying coal gas, and in utilizing compounds obtained in purifying coal gas.
2423. F. N. Clerk and C. Thomas, Birmingham—Imp. in cleavers or choppers.

Dated 24th October, 1859.

2424. A. L. Dowie, Glasgow—Imp. in gas burners, and in pressure regulating apparatus for the same.
2425. G. Holden, Preston, Lancashire—Imp. in machinery for spinning cotton and other fibrous substances.
2427. A. C. Bertrand, Paris—Imp. in the manufacture of herbal cigarrettes.
2428. R. A. Brooman, 166, Fleet-street—Imp. in daylight and other reflectors, and in the mode of supporting lamp reflectors. (A com.)
2429. M. Fitzpatrick, 29, Boulevart St. Martin, Paris—Apparatus to be applied to the prevention of accidents on railways, called "parachoc."
2430. R. Seager, Peter-street, Ipswich—Imp. in compounds of india-rubber and gutta-percha.
2431. W. E. Newton, 66, Chancery lane—Imp. in the construction of ships or vessels. (A com.)
2432. W. E. Newton, 66, Chancery-lane—Imp. in paddle wheels. (A com.)

Dated 25th October, 1859.

2433. H. S. Rosser, 17, Upper Philimore-gardens, Kensington—Imp. in electric telegraph cables, and in the mode of obtaining signals.

2437. W. A. Matthews, Sheffield—Imp. in springs.

2439. E. Ellis, St. Ann's Wells-road, Nottingham—Imp. in the manufacture of lace, and in apparatus employed therein.

2441. E. S. Tebbutt, Leicester—An improved manufacture of elastic fabrics.

Dated 26th November, 1859.

2443. W. Clark, 53, Chancery-lane—Imp. in the preparation and application of baths or bathing media, and in apparatus employed therein. (A com)

2445. J. Z. Kay, Dundee, N.B.—Imp. in gas meters, and in apparatus for maintaining or preserving the levels of liquids.

2447. J. H. Paterson, Glasgow—Imp. in shirting cloths and in shirts.

2451. C. E. Wilson and H. G. Hacker, Monkwell-street, London—Imp. in machinery for the manufacture of chenille.

2453. T. Whitby, Millbank-street, and W. Dempsey, Great George-street, Westminster—Imp. in ordnance and fire-arms.

Dated 27th October, 1859.

2455. C. Stevens, 1B, Welbeck-street, Cavendish square—A machine for scouring and polishing floors and decks of ships. (A com.)

2457. E. H. Rascol, 4, Brydges-street, Covent-garden—A new implement for cleansing of the plates, dishes, and other table or kitchen utensils. (A com.)

2459. R. M. Ordish, 18, Great George-street, Westminster—Imp. in railway fastenings.

2461. R. A. Brooman, 166, Fleet-street—Imp. in the preparation of red colouring matters or dyes. (A com.)

2463. H. Cowan, Boileau-lodge, Barnes, Surrey—An imp. in waistcoats, and certain other articles of wearing apparel.

WEEKLY LIST OF PATENTS SEALED.

[*From Gazette, November 4th*, 1859.]

November 4th.

1039. H. C. Hurry.
1122. H. Turner.
1131. H. Reynolds.
1132. R. A. Brooman.
1137. W. Kellingley.
1138. F. Angerstein, R. Clegg, and G. Thorrington.
1142. T. Jones.
1154. W. E. Gedge.
1156. W. Jeffery.
1163. A. Morton.
1164. E. T. Hughes.
1165. T. Green, jun.
1169. W. Wilkinson and C. Whitley.
1170. M. Defries.
1171. J. Norman.
1172. R. Thomson.
1173. G. Bell.
1182. H. Clarke.
1187. J. Leadbetter & J. Rhodes.
1190. J. Saxby.
1191. R. A. Brooman.
1205. J. T. Beale and T. N. Kirkham.
1213. J. Chatterton.
1229. R. Romaine.
1247. J. H. Johnson.
1259. E. Pasquier.
1288. D. S. Price.
1331. O. Maggs.
1358. W. H. Parkes and W. Bagnall.
1361. J. Wilson.
1390. R. Barclay.
1407. M. J. Haines.
1501. C. Clarini.
1748. A. Sidebottom.
1759. J. Wright.
1972. G. Collier.
1990. E. Ellis.
2081. H. G. Collins.
2131. P. Fairbairn.

[*From Gazette, November 8th*, 1859.]

November 8th.

1196. T. Scott.
1200. R. Gourlay.
1207. J. M. Munro.
1208. M. Leahy.
1296. J. Howard.
1306. J. Draper.
1374. R. Chrimes.
1569. N. Ardaseer.
1640. W. MacKean.
1645. H. Davies.
1915. W. A. Vérel.
2080. J. Mason.
2089. W. E. Newton.
2109. W. E. Newton.
2111. H. Jackson.

PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

[*From Gazette, November 4th*, 1859.]

October 31st.

2576. S. Tearne and G. W. Richmond.

November 1st.

2577. J. Nasmyth and R. Wilson.
2605. W. Seed and W. Ryder.

November 2nd.

2585. H. Bessemer.

[*From Gazette, November 8th*, 1859.]

November 3rd.

2824. C. W. Siemens.

November 4th.

2593. W. Weild.
2596. C. Titterton.
2617. R. A. Brooman.
2831. J. Latimer Clark.

November 5th.

2625. L. J. V. Vuitton.

PATENTS ON WHICH THE STAMP DUTY OF £100 HAS BEEN PAID.

[*From Gazette, November 4th*, 1859.]

October 31st.

683. J. J. Ziegler.

November 1st.

590. W. Petrie.

November 2nd.

624. E. Lord.

[*From Gazette, November 8th*, 1859.]

November 3rd.

649. A. L. Knox.
650. J. Wotherspoon.

November 4th.

656. Admiral the Earl of Dundonald.

LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4,206	Oct. 20th.	Connectors for connecting Bags to the Dash-boards of Vehicles	William Hewitt	Birmingham.
4,207	„ 21st.	Travelling Bag	Samuel Last	256, Oxford-street, W.
4,208	„ 28th.	A Daniell's Battery	John Muirhead	Gloucester-road, Regent's-park, N.W.

LIST OF PRESENTS.

The following presents have been made to the Society during the past year. The thanks of the Society have been forwarded to the donors.

Presents.	Donors.
Specifications of Patents up to the present time, and Indexes	Commissioners of Patents.
Abridgments of ditto	,,
Commissioners of Patents Journal	,,
Journal of the Geological Society, Vol. xv., parts 1, 2, 3, and 4	Society.
Journal of the Proceedings of the Linnæan Society, Vol. iii., Vol. iv., Nos. 13 and 14	,,
The Geologist for 1858, Vol. i.	S. J. Mackie, Esq.
London Sewage; shall it be Wasted, or Economised, by Chas. F. O. Glassford	The Author.
De Ijzerslahken in Nederland en de Ijzerbereiding in Vrosgeren, Tijd don, Prof. S. Bleekrode	The Author.
Memoirs of the Geological Survey of Great Britain, and of the Museum of Practical Geology. Mining Records, by Robert Hunt, F.R.S.	The Author.
Proceedings of the Royal Geographical Society, Vol. ii., No. 6; Vol. iii., Nos. 1, 2, 3, 4, 5	Society.
Canadian Naturalist and Geologist, Vol. iii., Nos. 5 and 6, Vol. iv., Nos. 1 and 2	Montreal Natural History Society.
Report on Vegetable Parchment, by Alfred Smee, F.R.S., &c.	The Author.
The Historical Tableaux, by Miss Bacon	The Authoress.
Quarterly Journal of the Chemical Society, Vol. xi., Nos. 43, 44, 45	Society.
Transactions of the Zoological Society, Vol. iv., pts. 5 and 6	,,
Proceedings of ditto, Nos. 363 to end of vol., parts 1 & 2, 1859	,,
Journal of the Statistical Society of London, Vol. xxi., part 4; Vol. 22, parts 1, 2, and 3	,,
On the Relative Power of Metals and Alloys to conduct Heat, by F. Crace Calvert	The Author.
American Journal of Science and Art, Nos. 78, 79, 80	B. Silliman, Esq.
Station Map of the Railways of Great Britain, by Z. Macaulay	The Author.
Tents, Tent Life, and Encamping, by Major Godfrey Rhodes	,,
Proceedings of the Literary and Philosophical Society of Manchester, Vol. xiv., No. 1	Society.
Memoirs ditto, Vol. xv., part 1	,,
Catalogue Colegii Yalensis, 1856	Yale College.
Annual Reports of the Board of Education of the New Haven City School Districts, 1857-8	,,

Presents.	Donors.
Proposed Plan for a Complete Organization of the School of Science connected with Yale College	Yale College.
An Address before the Alumni of Yale College, by James D. Dana	,,
Plan of an Agricultural School, by John A. Porter	,,
Art Exhibition in Yale College	,,
Discourses and Addresses at the ordination of the Rev. T. D. Woolsey, LL.D., to the Ministry of the Gospel, and his inaguration as President of Yale College in 1846	,,
Catalogue of the Officers and Students of Yale College	,,
The Geologist, Vol. ii., Nos. 13 to 23, inclusive	T.A.Readwin,Esq
History of the Royal Sappers and Miners, Vols. i. and ii., by T. Connolly	C. Wentworth Dilke, Esq.
The British Army in India; the state of India, &c., by Julius Jeffreys	The Author.
Transactions of the Historic Society of Lancashire and Cheshire, Vol. x., 1857 8	Society.
A General Account of the Manchester Exhibition of 1857, by George Scharf, Jun.	The Author.
Historic Notes on the Sculpture in the Manchester Exhibition, by George Scharf, Jun.	,,
Reports on the Paris Universal Exhibtion; 1, 2, and 3	Department of Science and Art.
Histoire de la Formation de la Société d'Encouragement pour l'Industrie Nationale, Paris	Society.
Prospectus of ditto	,,
Comptes Rendus des Travaux du Congrès de la Propriété Littéraire et Artistique, par Mons. E. Romberg (Tomes i. & ii.)	The Author.
Rapport sur la 26ième classe de l'exposition universelle de Paris	,,
Rapport présenté par M. E. Romberg au nom du Jury de l'exposition d'économie domestique de Bruxelles	,,
Code Industriel, ou Recueil des Lois et Dispositions concernant l'exercice de l'Industrie, suivi d'un Formulaire	,,
Annuaire de l'Industrie, du Commerce, et de la Banque en Belgique, d'après des documents Recueillis et mis en ordre par M. Romberg (1 et 2 Année)	,,

Presents.	Donors.
Report of the Transactions of the Silesian Society for National Culture for 1857	Mons. B. Heleber.
Journal of the Royal Agricultural Society, Vol xix, part 2; Vol. xx., part 1................................	Society.
On the introduction of a system of Decimal Coinage, by the Rev. Canon Richson	The Author.
On the Statistics of Marriages in England, by S. M. Drach	,,
First Annual Report of the South Yorkshire Viewer's Association...	The Association.
The Chrono-Astrolabe, by J. Bowman Lindsay...........................	The Author.
Journal of Proceedings of the Linnæan Society—Supplement to Botany, Nos. 1 and 2....................	Society.
Transactions of ditto, Vol. xxii., part 3....................................	,,
List of Members of ditto	,,
New Strategies of Warfare, by John Macintosh............................	The Author
Proceedings of the Royal Society, Vol. ix., Nos. 33, 34, 35, 36	Society.
Copies of Reports of the Royal Humane Society for 1801, 5, 7, 8, 10, 11, 13, 14, 16, 17, 18, 20, 22, 23, 24 to 1830, 32, 34, 35, 36, 37, 38, 39, and 1840 to 1858............	,,
The Building News for 1858, Vol. iv.	The Proprietor.
Plane Trigonometry, by J. Todhunter	The Author.
Report of the Sanitary Condition of the City of London for 1857-8, by Henry Letheby, M.B...............	,,
Tents; a lecture by Major Rhodes	,,
Statistics of New Zealand for the year 1857	Colonial Secretary, Auckland, New Zealand.
Report of the Musée d'Art et d' Industrie à Lyon, par M. Natalis Rondot	Author.
Notice du Vert de Chine, &c., par M. Natalis Rondot	,,
United States Patent Office Reports for 1856; Mechanics, 3 vols.	U.S. Patent Office
Transactions of the Academy of Science of St. Louis Vol. i., No. 2	Acadmy.
Proceedings of the American Academy of Arts and Sciences, Vol. iii.	,,
Smithsonian Miscellaneous Collections, Meteorological and Physisical Tables	Smithsonian Institution.
Meteorology in its connection with Agriculture, by Professor Joseph Henry	,,
Chart of Chicago (Illinois) Harbour and Bar, by Lt. Col. J. D. Graham	The Author.
Report of the Superintendent of the U. S. Coast Survey for 1856......	,,
Elements of Geometry and Trigonometry, by Prof. Sestini	Georgetown College.
Treatise of Analytical Geometry by Rev. B. Sestini........................	,,
Treatise on the Use of the Globes, by J. Wallace	,,
Treatise on Algebra, by B. Sestini...	,,

Presents.	Donors.
Elementary Algebra, by B. Sestini	Georgetown Coll.
Lloyd's Register of Shipping for 1857, 2 vols	Thos. Chapman, Esq.
Handbook of the Cotton Trade, by Thomas Ellison	The Author.
A Key to Proportions of the Parthenon, No. 1 and 2, by J. Jopling...	,,
A Treatise on Problems of Maxima and Minima solved by Algebra, by Ramchundra	Secretary of State for India.
A Compendium of Universal History, Ancient and Modern, by the Rev. W. Legge	The Author.
A glance at the Rise and Constitution of the Royal Academy of Arts of London, by John Pye ...	,,
Commentaries on International Law, by Robert Phillimore, M.P.	,,
Patronage of British Art, by John Pye	The Author.
Wreck Chart of the British Isles for 1858	Royal National Life Boat Institution.
Papers read at the Royal Institute of British Architects, 1858-9	Institute.
Address at the Anniversary Meeting of the Royal Geographical Society, 1859	Society.
Smithsonian Contributions to Knowledge, Vol. x............................	Smithsonian Institution.
Report of the Smithsonian Institution for 1857............................	,, ,,
Defence of Dr. Gould by the Scientific Council of the Dudley Observatory	Dr. Gould, Jun.
Reply to the Statement of the Trustees of the Dudley Observatory, by Dr. Gould..................................	,, ,,
Historical Account of the Introduction of the Galvanic and Electro-Magnetic Telegraph, by Dr. Hamel	The Author.
The Life and Times of Samuel Crompton, by Gilbert J. French	,,
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ERRATA.

Page 54, col. 2, line 38, for "10 miles an hour," read "1 mile an hour."
„ 453, col. 2, line 16, for "4th of December," read "5th of December."
„ 501, col. 2, line 27, for "132," read "13."
„ 598, col. 2, line 54, read,—"In 1838, Schweigger was no longer editor of any journal."
„ 606, col. 2, line 61, for "on the 13th of March," read, "in the beginning of April;" and in line 62, for "Opotchinius," read "Afrosimows."
Page 607, col. 1, line 8, read,—"He collected a great many precious Chinese, Thibetan, Mongolian, and other writings." On the same page and column, line 63, for "1835," read "1803."
„ 726, col. 1, line 21, for "112·10," read "11,210."
„ „ col. 2, line 34, for "each ind.," read "each 10 ind."
„ 727, Table D., col. 7, line 27, for "448," read "248."
„ „ heading of third division, for "25 knots," read "20 knots."

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